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US Army Corps
of Engineers
Hydrologic Engineering Center

GENERALIZED COMPUTER PROGRAM

HEC-4

Monthly Streamflow Simulation

User's Manual

February 1971

CPD-4

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MONTHLY STREAMFLOW SIMULATION

HYDROLOGIC ENGINEERING CENTER
COMPUTER PROGRAM 723-X6-L2340

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HEC-4

MONTHLY STREAMFLOW SIMULATION

HYDROLOGIC ENGINEERING CENTER
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1. ORIGIN OF PROGRAM

This program was prepared in The Hydrologic Engineering Center, Corps of Engineers. Up-to-date information and copies of source statement cards for various types of computers can be obtained from the Center upon request by Government and cooperating agencies. Programs are furnished by the Government and are accepted and used by the recipient upon the express understanding that the United States Government makes no warranties, express or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data contained in the programs or furnished in connection therewith, and the United States shall be under no liability whatsoever to any person by reason of any use made thereof.

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2. PURPOSE OF PROGRAM

This program will analyze monthly streamflows at a number of interrelated stations to determine their statistical characteristics and will generate a sequence of hypothetical streamflows of any desired length having those characteristics. It will reconstitute missing streamflows on the basis of concurrent flows observed at other locations and will obtain maximum and minimum quantities for each month and for specified durations in the recorded, reconstituted and generated flows. It will also use the generalized simulation model for generating monthly streamflows at ungaged locations based on regional studies. There are many options of using the program for various related purposes, and it can be used for other variables such as rainfall, evaporation, and water requirements, alone or in combination.

3. DESCRIPTION OF EQUIPMENT

This program requires a FORTRAN IV compiler, a random number generator (function RNGEN included, see exhibit 2), and a fairly large memory (64K on the CDC 6600). Provision is made for use of three scratch tapes, 7 (for punched output), 8 and 9.

4. METHODS OF COMPUTATION

a. In the statistical analysis portion of this program, the flows for each calendar month at each station are first incremented by 1 percent of their calendar-month average in order to prevent infinite negative

logarithms. This increment is later subtracted. The mean, standard deviation and skew coefficients for each station and calendar month are then computed. This involves the following equations:

$$X_{i,m} = \log (Q_{i,m} + q_i) \tag{1}$$

$$\bar{X}_i = \sum_{m=1}^{N} X_{i,m}/N \tag{2}$$

$$S_i = \sqrt{\sum_{m=1}^{N} (X_{i,m} - \bar{X}_i)^2 /(N-1)} \tag{3}$$

$$g_i = N \sum_{m=1}^{N} (X_{i,m} - \bar{X}_i)^3 \;/\; ((N-1)(N-2)S_i^3) \tag{4}$$

in which:

- X = Logarithm of incremented monthly flow
- Q = Monthly recorded streamflow
- q = Small increment of flow used to prevent infinite logarithms for months of zero flow
- $\bar{X}$ = Mean logarithm of incremented monthly flows
- N = Total years of record
- S = Unbiased estimate of population standard deviation
- g = Unbiased estimate of population skew coefficient
- i = Month number
- m = Year number

b. For each station and month with incomplete record, a search is made for longer records among the stations used, to find that which will contribute most toward increasing the reliability of the statistics computed from the incomplete record. The mean and standard deviation are then adjusted. Equation 5 is used to compute the equivalent record required to obtain statistics equally reliable to these adjusted statistics and is the basis for selecting the best record to be used in the adjustment. Equations 6 and 7 are the adjustment equations.

$$N_1' = \frac{N_1}{1 - \frac{N_2' - N_1}{N_2'} R^2} \tag{5}$$

$$\bar{X}_1' - \bar{X}_1 = (\bar{X}_2' - \bar{X}_2)\ RS_1/S_2 \tag{6}$$

$$S_1' - S_1 = (S_2' - S_2)\ R^2 S_1/S_2 \tag{7}$$

The primes indicate the long-period values and those without primes are based on the same short period for both stations 1 and 2, and:

N = Length of record
R = Linear correlation coefficient

c. Each individual flow is then converted to a normalized standard variate, using the following approximation of the Pearson Type III distribution:

$$t_{i,m} = (X_{i,m} - \bar{X}_i) / S_i \tag{8}$$

$$K_{i,m} = 6/g_i \left[((g_i t_{i,m}/2) + 1)^{1/3} - 1 \right] + g_i/6 \tag{9}$$

t = Pearson Type III standard deviate
K = Normal standard deviate

d. After transforming the flows for all months and stations to normal, the gross (simple) correlation coefficients R between all pairs of stations for each current and preceding calendar month are computed by use of the following formula:

$$R_{i,i-1} = \left\{ 1 - \left[1 - \left(\sum_{m=1}^{N} x_{i,m} x_{i-1,m} \right)^2 / \left(\sum_{m=1}^{N} x^2_{i,m} \sum_{m=1}^{N} x^2_{i-1,m} \right) \right] (N-1)/(N-2) \right\}^{\frac{1}{2}} \tag{10}$$

in which:

$x = X - \bar{X}$

e. If there are insufficient simultaneous observations of any pair of variables to compute a required correlation coefficient, that value must be estimated. Each missing value is estimated by examining its relationship to related pairs of values in the current and preceding month by use of the following formula using i, j, and k subscripts to indicate variables used in the gross correlation.

$$R_{ij} = R_{ki}R_{kj} \pm \sqrt{(1 - R_{ki}^2)(1 - R_{kj}^2)} \qquad (11)$$

Since, in order to be consistent with the two related correlation coefficients, the correlation coefficient must lie between the limits given by equation 11, the lowest upper limit and highest lower limit are established for all related pairs, and the average of these two limits is taken as the estimated correlation coefficient.

f. Monthly streamflows missing from the records of the various stations are estimated for all stations for each month in turn. Accordingly, whenever a missing flow is being reconstituted, there always exists a valid value for all stations already examined that month and for all remaining stations in either the current or preceding month. For these remaining stations, the current value is selected where available; otherwise the preceding value is used. In order to reconstitute the missing value, a regression equation in terms of normal standard variates is computed by selecting required coefficients from the complete correlation matrix for that month and solving by the Crout method (See exhibit 1). The missing value is computed from this regression equation, introducing a random component equal to the nondetermination of the equation, as discussed in the streamflow generation procedure.

g. It has been found that valid use of the regression technique requires that all correlation coefficients agree with the data that will be substituted into the equations and that the correlation coefficients be mutually consistent. Inconsistency in the correlation coefficients causes the dependent variable to be over-defined and is evidenced by a determination coefficient greater than 1.0. If this occurs (because of incomplete data), the independent variable contributing least to the correlation is dropped, and a new regression equation is computed. This process is repeated as necessary until consistency is reached (which must occur by the time that only one independent variable remains). In order to make the correlation matrix consistent with the data matrix, all affected correlation coefficients are recomputed after each estimate of missing data.

h. Normal standard deviates are then converted to flows by use of the following equations:

$$t_{i,m} = \left\{ \left[(g_i/6)(K'_{i,m} - g_i/6) + 1 \right]^3 - 1 \right\} 2/g_i \tag{12}$$

$$X_{i,m} = \bar{X} + t_{i,m} S_i \tag{13}$$

$$Q_{i,m} = \text{Antilog } X_{i,m} - q_i \tag{14}$$

imposing the constraint:

$$Q_{i,m} \geq 0 \tag{15}$$

i. When the set of flows is complete, all correlation matrices should be consistent except for truncation errors in the computer, since the data arrays are complete. Any consistency of matrices obtained in this manner or of matrices read into the computer will result in determination coefficients greater than 1.0. If this occurs, consistency of each correlation matrix is assured by first testing all combinations of triads of correlation coefficients in the current and preceding month for all calendar months using equation 11 and raising the lowest of the three coefficients to obtain a consistent triad. The test of consistency of each complete matrix is made by recomputing the multiple correlation coefficient. If this value is greater than 1.0, further adjustment is required. Such further adjustment is obtained by introducing a coefficient, successively smaller by 0.?, on the radical in equation 11 and repeating all triad consistency tests until all matrices are consistent. If consistency is not reached, coefficients in each inconsistent matrix are moved toward the average value of all coefficients in that matrix until consistency is reached.

j. Generation of hypothetical streamflows is accomplished by computing a regression equation, by the Crout method (described in exhibit 1) for each station and month and then computing streamflows for each station in turn for one month at a time using the following equation. This process is started with average values (zero deviation) for all stations in the first month and discarding the first 2 years of generated flows.

$$K'_{i,j} = \beta_1 K'_{i,1} + \beta_2 K'_{i,2} + \ldots + \beta_{j-1} K'_{i,j-1} + \beta_j K'_{i-1,j} + \beta_{j+1} K'_{i-1,j+1} + \ldots + \beta_n K'_{i-1,n} + \sqrt{1-R^2_{i,j}} \; Z_{i,j} \tag{16}$$

in which:

K'	=	Monthly flow logarithm, expressed as a normal standard deviate
β	=	Beta coefficient computed from correlation matrix
i	=	Month number
j	=	Station number
n	=	Number of interrelated stations
R	=	Multiple correlation coefficient
Z	=	Random number from normal standard population

k. Maximum, minimum and average flows are obtained for the entire period of flows as recorded and for specified periods of reconstituted and generated flows by routine search technique.

l. Provision is also included in this program for use of the generalized model requiring only 4 generalized coefficients for each station (in place of 48) and one generalized correlation coefficient (in place of 12) for each pair of stations, in addition to identification of wet and dry seasons for each station. These are defined as follows:

(1) The average value of mean logarithms of flows for the wet season (3 months). This value plus 0.2 is applied to the middle month and the average minus 0.1 is applied to the other 2 months.

(2) The average value of mean logarithms of flows for the dry season (3 months). This is applied to all 3 dry months. Mean logarithms for months between dry and wet seasons are interpolated linearly.

(3) The average standard deviation for all 12 months. This is applied to each of the 12 months.

(4) The average serial correlation coefficient for all 12 months. This value minus .15 (but not less than zero) is applied to each wet-season month, and the value plus .15 (but not more than .98) is applied to each dry-season month. The average value is applied to all intermediate months.

(5) The average interstation correlation coefficient for all 12 months is applied to each month for that pair of stations.

m. Because of limitations in computer memory size and because of increasing change of computational instability with larger matrices, the number of stations usable simultaneously in this program has been limited to 10. However, the program can reconstitute and generate streamflows for

any number of stations in groups of 10 or less. It will ordinarily be desirable to include one or more stations from earlier groups in each successive group in order to preserve important correlations. In addition to providing flow data for all stations, it is necessary to designate NPASS and to follow each group of flow data with a standard-format card with NSTX (number of stations in next pass that were also used in preceding passes) and station identification numbers for those stations. These numbers must be listed in the same sequence as their data were arranged in earlier passes. Data for the new stations for the new pass should then be read. None of these flows can occur in a year later than the latest year for which flow data occurred in the first pass.

n. As soon as flows are reconstituted for any pass, they are read onto the flow tape. After statistics are computed from transformed reconstituted flows, they are read onto the statistics tape (after identification of stations in the pass for future reference). Final regression equation data for each pass are read onto the same tape at the same time (for use in generation later). For each new pass, the flow and statistics tapes are searched separately for data for those stations already used that also occur in the new pass. In order to read and write intermittently and alternatively on the same tapes, it is necessary to keep track of tape records so as to assure that any read statement does not read beyond the record mark and so that new write statements occur at the end of all previous write statements that are to be saved.

o. Once that statistics are put on tape, they are retained throughout the reconstitution and generation processes. Flows, however, are saved only for the set of data in which they were reconstituted or generated, until the last pass for that set is completed. In the generation process, it is necessary to save the last flow generated for each station in one set for use as the antecedent flow in starting generation in the next set. These are saved in the QSTAP array with subscript ISTAP.

5. INPUT

Input is summarized in exhibits 7 and 8. Data are entered consecutively on each card using a simple variety of formats to simplify punching and handling cards. Computed and generated flows cannot be 1,000,000 units or larger, and consequently must be expressed in units that cannot exceed this magnitude. Units should be indicated on one of the 3 header cards. Column 1 of each card is reserved for card identification. These are ignored by the computer except for the A in column 1 of the first header card, which is used to identify the first data card. An example of input is given in exhibit 3. Certain inadequacies of data will abort the job and waste input cards until the next card with A in column 1 is reached. A card with A in column 1 followed by 4 blank cards causes the computer to stop.

6. OUTPUT

Printed output includes key input information for job identification and all results of computations. Generated flows are put on magnetic tape, and computed statistics are punched on cards in the format usable later by the program. An example of printed output is given in exhibit 4.

7. OPERATING INSTRUCTIONS

Standard FORTRAN IV instructions and random number generator are required. No sense switches are used.

8. DEFINITIONS OF TERMS

Terms used in the program are defined in exhibit 5 .

9. PROPOSED FUTURE DEVELOPMENT

There are cases where the model used herein does not reproduce historical droughts with reasonable frequency. Consequently, the model is under continuous study and development. It is requested that any user who finds an inadequacy or desirable addition or modification notify The Hydrologic Engineering Center.

DETAILED EXPLANATION
OF
COMPUTER PROGRAM

GENERAL

Much of the program is explained by comment cards and definitions of variables. Supplementary explanation follows, referring to sections identified with the indicated letter in column 2 of a comment card.

SECTION A

Correlation coefficients, R, and beta coefficients, B, are in double precision for matrix inversion computation, in order to minimize computational instability. Correlation coefficient, RA, as originally computed and stored, may be defined in single precision. For computers with word length smaller than 32 bits, many other variables in this program should be in double precision.

When dimensions are changed, the corresponding variable (starting with K) should be changed accordingly, as these are used to prevent exceedence of dimensions. If an excessive subscript is used, the job will be dumped until a card with A in column 1 is encountered, at which time a new job is automatically started. If 5 blank cards (with an A in column 1 of the first) are encountered, the run will be terminated. Job specification cards are read in this section.

SECTION B

NSTAX is number of columns in correlation matrix. These consist of NSTA columns for the current-month values and a similar number for antecedent-month values. NSTAA is initial column number for antecedent-month coefficients. These are computed from NSTA, which is read in if statistics are to be provided, rather than computed from raw data. If raw data are to be used, NSTA is defined in the program later and NSTAA and NSTA must be also. Data for each new pass are processed after transferring back to statement 42. In the multipass operation, NSTX is the number of stations used from previous passes and NSTXX is the subscript of the first new station for the current pass. Station identification for the NSTX stations must be in the order in which data for those stations were originally used, because search of data and statistics on tape is made in this order. Flows for these stations are read from tape IQTAP, and corresponding statistics from tape ISTAT. Variables LQTAP and LSTAT are used to keep track of tape position for subsequent writing.

*Provided through the cooperation of the Texas Water Development Board.

Months are identified consecutively by the variable M starting with the month preceeding the first year of data. Some quantities to be accumulated are initialized. Station combination data are stored for the purpose of obtaining maximums and minimums (section D) of weighted flow values later. Tandem stations are identified for cases where a check on consistency of generated quantities is deemed appropriate. Station identification numbers are set to a large number so they will not be undefined. The flow array is filled with -1 values to indicate missing values. For each station and calendar month, the total flow and number of recorded values are computed for computing a flow increment and other statistics later. The minimum flow for each station month is also computed in order to avoid negative logarithms later.

SECTION C

Station data can be read in random order. Stations are identified by subscript in the order in which data for each station are first read. The year subscript is computed. Negative subscripts will occur if data are for years earlier than the starting year indicated on B card, and data for these are rejected, with diagnostic printout. The stations are counted and the flows for each month at each station are counted for the purpose of computing frequency statistics later. If the number of stations or years exceeds its dimension limit, the job is aborted. The number of stations is permanently stored in the NSTNP array for later identification in multipass operations. The remainder of this section is self explanatory, except to state that permanent identification station numbers are given for stations in combination, for tandem stations, and for consistency-test stations, and subscripts are identified for rapid computation later.

SECTION D

In this section, maximum and minimum recorded flows for each calendar month , the water year and for durations of 1, 6, and 54 months, and average flows are computed for each station and combination. Durations do not span a break in any record. Quantities are rounded off and printed in fixed-point format.

SECTION E

The logarithm transform of flows is accomplished here. Missing values are indicated by an impossibly large number (the -1 used for missing flows is a reasonable logarithm and therefore cannot be used for missing logarithms). Before the log transform, the average flow for each calendar month at each station is computed and one (constrained to a minimum of 0.1 flow unit) is added to each flow. If the minimum observed flow for that station month is negative, that absolute value

is also added before the transform. After the logarithm transform, frequency statistics for each calendar month and station are computed. An increment needed to convert the logarithms to an approximately normal distribution is also computed as an alternative future transform. Logarithms to the base 10 are used so that statistics are comparable to other commonly used statistics. A variable IRCON is set to 1 if any missing values are encountered, so that the flow reconstitution routine will be called later. A variable INDC is set to 1 if the first approximation of increments causes any one of the skew coefficients to be smaller than 0.1 or larger than 0.1. In an optional routine that follows, the increment for each station and calendar month is adjusted individually and iteratively (up to 14 trials) until skew is within 0.1 of zero.

Stations with less than three years of data for any calendar month are deleted, since skew and correlation computations require at least three items of data.

SECTION F

Correlation matrices are computed here for the purpose of adjusting frequency statistics for short-record stations. All correlation coefficients are first set to -4.0 in order to identify those not computed later for lack of sufficient observed data. Then accumulations of the various quantities required are computed for all items above the main diagonal in the correlation matrix for each month, using all data common to the two stations involved. If more than two items of data are available, the correlation coefficients are computed. Coefficients for the main diagonal are set to 1.0, and those below the main diagonal are set equal to their symmetrical element. Coefficients between the current and preceding month's values are similarly computed. These items constitute an extension of the matrix to the right, which doubles its size, and the new portion is not necessarily symmetrical. Similar complete arrays of average values and root-mean-square values for only those logarithms common to each pair of stations are found for later use in adjusting statistics.

A search is then made to determine the station that would be most useful in adjusting statistics for station months with incomplete record, and the means and standard deviations are adjusted in accordance with the following equations:

$$S_1' = S_1 + (S_2' - S_2)\ R^2 S_1/S_2$$

$$\bar{X}_1' = \bar{X}_1 + (\bar{X}_2' - \bar{X}_2)\ R S_1/S_2$$

where primes indicate long-period values, subscripts are 1 for the short-record station and 2 for the long-record station and,

$\overline{X}$ = mean logarithm

S = standard deviation of the logarithms

R = correlation coefficient.

An optional check of consistency of standard deviations between adjacent stations for the same month is next made. This is to assure that frequency curves do not cross within three standard deviations from the mean. If there is a conflict, the standard deviation of that station designated in the input data as the dependent variable is modified accordingly. All frequency statistics are then printed out.

SECTION G

All flows are next standardized by subtracting the mean and dividing by the standard deviation for the month and station. An approximate Pearson Type III transform is then applied as follows:

$$K = 6\left[(.5\,gt + 1)^{1/3} - 1\right]/g + g/6$$

where:

K = normal standard deviate
t = Pearson Type III standard deviate
g = skew coefficient

New correlation matrices are then computed, based on the normalized variates and using the same standard procedures previously employed for correlating logarithms. The sign of the correlation coefficient is preserved, since the coefficient will be used to establish regression equations. Correlation coefficients are set to zero if the variance of either variable approximates zero, since the computation of the coefficient is highly unstable and since its use would be of little value.

SECTION H

For jobs where correlation data are given, the portion of the correlation matrix above the main diagonal for all months and the entire correlation matrix relating current and preceding month's values are read, with a different card for each pair of stations. Values for all 12 months are contained on one card, and the two stations involved are identified on the same card. An automatic check is made to assure that cards are in the required order of columns and rows in the correlation matrix. When generalized statistics are used, only one correlation coefficient for the entire year is read, but card order is the same. Symmetrical elements below the main diagonal are then filled in and values af 1.0 are placed in the main diagonal.

Frequency statistics are then read, 4 cards per station, with 12 monthly values and station identifications on each card. A check is made of the station order, to assure proper subscripting. When generalized statistics are used, only one card per station is read, and this contains the maximum and minimum mean logarithms and the average standard deviation for the year. The months of maximum and minimum mean logarithms are also read and converted to corresponding subscripts. These subscripts will differ from the calendar month number if the year used in the study does not begin with January.

SECTION I

This section searches for each calendar month the entire correlation matrix to be the right of the main diagonal for misiing correlation coefficients due to the nonexistence of at least three years of simultaneous data for the month. As soon as a coefficient between two variables is identified as missing, a search of the correlation matrix is made to find established correlation coefficients between each of these variables (i and j) and any other variable (k). The range within which correlation between the two variables must lie in order to be mathematically consistent with the correlation with the third variable is established by use of the following equation:

$$R_{ij} = R_{ki} R_{kj} \pm \sqrt{(1-R_{ki}^2) (1-R_{kj})^2}$$

As each successive third variable with established correlation coefficients is found, the upper limit of R_{ij} is constrained to the lowest of all upper limits computed, and the lower limit is constrained to the highest of all such lower limits computed. When the entire matrix has been searched the correlation coefficient is estimated as the average of these two constrained limits. If this element is above the main diagonal, the value is also entered for the element symmetrically across the main diagonal. The search for further missing correlation coefficients is then continued.

SECTION J

Where a correlation matrix is not to be used for reconstituting data but might be inconsistent, a triad consistency test can be made in this section. This is done by examining all groups of three related correlation coefficients, and testing the lowest one to determine whether it is above minimum constraint established by the equation in the preceding station. If not, it is raised to that minimum. When this is done, it is possible that the adjusted coefficient had already been used in another triad test, and consequently that previous test would need to be repeated. In order to do this properly, the entire matrix is searched up to 12 NSTA times, where NSTA is the number of stations, until a complete search reveals no inconsistent triad (INDC = 0).

EXHIBIT 1

A coefficient FAC of the radical in the equation is used in order to obtain complete matrix consistency in difficult cases, whenever possible by this means. A test for overall consistency is made in section K, and if this fails. FAC is successively reduced by 0.2 until overall consistency is reached.

SECTION K

The test for overall consistency of the correlation matrix for each month is made by constructing for each station the correlation matrix that would be used in flow generation for that station and computing the multiple determination coefficient. If the determination coefficient of the matrix for any station and any month exceeds 1.0, all correlation matrices must be reexamined, since some coefficients are common to two or more matrices. This is done by reducing FAC in the triad test (section J) by 0.2 and repeating all triad tests. If FAC is reduced to zero and consistency is not obtained, an index of NCB is set to 1 and an averaging routine is used for each inconsistent matrix. A quantity SUM is computed as the average of all correlation coefficients in that matrix, and each element is modified by multiplying SUM by the excess of determination coefficient and adding this product to the product of the complement of this multiplier and the value of the element in the inconsistent matrix. The averaged or smoothed values are replaced in the complete matrix for the month, and this requires some careful manipulation of subscripts. A new computation of determination coefficient is made and the smoothing process is repeated up to nine times until consistency prevails. If this does not occur, the job is terminated. When consistency is established all complete matrices are printed out and essential elements are punched if desired.

SECTION L

In reconstituting missing data, a search is made for each month of record starting with the first for stations that have no record during that month (Q=T). When one is found, a search of all other stations is made to determine whether recorded or previously reconstituted flows exist for the current month or, if not, for the preceding month. If one is found, it will constitute an independent variable for estimating the missing value, and its value and pertinent correlation coefficients are stored in new arrays for computation purposes. The correlation coefficients with the dependent variable is temporarily stored in the NVAR (NSTA+1) column to assure that coefficients relating independent variables which have sufficient array space (they cannot exceed NSTA in number). A variable ITEMP counts the number of independent variables (stations for which recorded or reconstituted data are available). It is incremented after its set of correlation coefficients are stored in the R array, and is finally used to relocate the correlation coefficients involving the dependent variable. If no independent variables with data

are found, as can happen in the first month of record, a correlation is made with the preceding value for the same station and that preceding value is arbitrarily set at the average for the month. The regression equation and determination coefficient are then computed using subroutine CROUT. The variable having the lowest absolute value of correlation with the dependent variable is identified, and beta coefficients are searched in order to eliminate all unreasonable coefficients. In the usual case where the simple correlation coefficient between any variable and the dependent variable is positive, unreasonable coefficients are assumed to be those larger than 1.5 or smaller than -.5. In the case where the variable correlates negatively with the dependent variable, the reasonable range is -1.5 to 0.5. If an unacceptable coefficient is found, INDC is set to 1. If this happens or if the determination coefficient does not lie between 0 and 1.0, the variable with the smallest correlation coefficient is eliminated, the correlation array reconstructed accordingly, and the regression equation recomputed. This process is repeated until all required conditions exist. The missing value is then computed by use of the regression equation and adding a random component normally distributed with zero mean and with variance equal to the error variance of the regression equation.

As soon as the missing value is estimated a search is made for all established values in the current and preceding month with which it is to be correlated, and sums of logarithms, squares, and cross products are incremented in preparation for recomputing all affected correlation coefficients. After checking for sufficient (three years) record and nonzero variance, the correlation coefficient is recomputed. If the standard deviation of either variable is very small, the correlation coefficient is set to zero. If the coefficient is above the main diagonal of the correlation matrix, its value is also assigned to symmetrical element. Since estimation of a missing value affects correlation coefficients between variables in the current and following month, which coefficients are stored in a different matrix, this process of adjusting the correlation coefficient is applied to those values next.

SECTION M

After all flows are reconstituted, the flow tape is read until the proper position for writing the newly computed flow data on that tape is reached, and headings are printed for writing flows on the printer later. Then the standard deviates are converted to flows by reversing the Pearson type III transform, multiplying by the standard deviation, adding to the mean and taking the antilogarithm. The increment is then subtracted and if the resulting value is negative for a variable with zero lower limit, it is set to zero. In the case of reconstituted flows, the Pearson Type III transform is constrained so that the excess of the standard deviate over and above 2.0 is multiplied by a maximum of 0.3 (if the standard

diviation exceeds 0.3). This simply prevents obtaining unreasonably extreme values due to sampling errors. It is a moderation of the extrapolation rather than an abrupt truncation.

The test for tandem station consistency is next made, and inconsistent flows are identified for printout and changed to the limit of consistency. The downstream flow is made consistent with the sum of upstream flows. Flows are punched on cards, if desired, printed out, and written on the flow tape for use in future passes. NQTAP is incremented and represents the total number of records on the tape.

SECTION N

After converting deviates to flows, the frequency statistics are recomputed in order to agree accurately with observed and reconstituted data. If a consistency test is called for, the variable ITRNG is set to 2 and computation is transferred to near the end of section F, where the test is made and the transfer index causes a return to this portion of the program. Adjusted statistics are printed, and the consistent correlation matrix is printed (and, if desired, also punched) by transfer to section K, using ITRNG as a return indicator again. The statistics are then punched, if desired. Flows for the specified station combinations are then computed.

SECTION O

Maximum and minimum recorded flows are computed by transfer to section S, using ITRNG=1 as a return indicator. The variable ITMP keeps a record of the remaining years whose maximum and minimum flows have not been searched yet.

Next, generalized statistics are computed, if desired, (if IGNRL equals two). As indicated, straight averages of all 12 monthly correlation coefficients in every category are taken. Means are averaged for the three wettest consecutive months and the three driest consecutive months and the seasonal timing noted. Standard deviations for all 12 months are averaged. Generalized statistics are then printed out.

Next, generalized statistics read in section H are used to compute required arrays of statistics. Skew and increments are set to zero. The mean for the middle month of the wet season is .2 higher than the wet season average and means for the other two months are .1 lower. Means for the dry seasons are uniform, and means for the transition seasons are interpolated linearly. Correlation coefficients for the dry season are .15 higher (constrained below .98) than the annual average, and those for the wet season are .15 low (constrained above zero). All of these operations are in accord with the generalized model developed in HEC.

SECTION P

After obtaining monthly statistics and correlation matrices, regression equations for each station and calendar month are computed. Flows are generated in the station order in which data or statistics are read and are generated for each month at all stations before proceeding to the next month. Flows at each station are correlated with flows of the antecedent month at that station and at all stations for which the current month's flows have not yet been generated. For other stations, flows for the current month are used.

Regression equations are computed in subroutine CROUT. If any correlation matrix formed is inconsistent (which should not occur at this stage, except for truncation of computated intermediate variables), a transfer to section J is effected, and consistency operations performed on all correlation matrices. After such a transfer, all regression equations must be recomputed, since any correlation coefficient might have changed. After this, only the beta and alienation coefficients need be retained, in addition to the frequency statistics. In the multipass operation, these are all written on tape ISTST at this point.

SECTION Q

A routine for projecting historical sequences into the future is employed here. Values of QPREV (previous month's deviate) for each station is determined as the transform of the flow for the month preceding the first month specified (by input data) to be generated. The variable MA is computed for the subscript of Q that conforms to the first month of projected flows. If the projected flow routine is not to be used, the computer is next set up to generate two years of flows, at the end of which synthetic sequences will have a virtually random start.

In the multipass operation, stations are identified and all necessary statistics are contained in the order needed on tape ISTAT. In any pass after the first, flows generated in earlier passes for the same period (the same sequence of data) must be read from tape IQTAP, and this tape must be rewound before each pass in order to permit a complete search. In any sequence after the first, the preceding flow for the first month to be generated is the last flow in the preceding sequence for that station, and these are saved in the QSTAP array for multipass operation. If the multipass feature is not used, all necessary statistics and flows for generating are in memory.

SECTION R

In starting to generate flows, a variable JXTMP is used to identify the year number of the first year of each sequence in the multipass

operation. Variables AVG and SDV are used to compute the mean and standard deviation of the deviates for each flow sequence. These are later used to adjust all deviates so that the means and standard deviations in every generated sequence will be the same as those of the historical sequence.

Variables JA and NJ are set up to correspond to the first and last year of generation in each successive sequence, depending on the type of operation. MA has already been set up as the subscript of Q corresponding to the first month of flows to be generated (for use in projecting historical flows recorded to the current time). QPREV for each station has been identified as the previous month's flow for that station. Flows are then generated for each station, using stored regression equations and a random component. Each generated flow is immediately entered into the QPREV array, because its preceding flow will never again be used in that pass.

In the multipass routine, flows (as deviates) are written on tape at the end of each pass, and the last flow for each station is stored in the QSTAP array for use in the next sequence.

If more than 19 years (an arbitrarily selected length) of flow are being generated in any sequence, deviates are adjusted so that their mean is zero and variance 1.0. Their unadjusted mean and standard deviation are printed. Then they are transformed to flows, and, if called for, consistency tests between stations are made. For variables with zero natural limit, a check for negative values is then made. Flows are then printed and, if desired, punched. Flow combinations are then computed.

SECTION 3

Before computing maximum and minimum values of generated flows, a positive value of JX is looked for to assure that flows generated are not to be discarded (the first two years generated for a random start). Also, at least NYMXG years must have been generated before maximum and minimum values are computed (this applies only when the number of years remaining for generation in the last sequence does not equal NYMXG). Maximum sums are initiated at an extremely large negative number and minimum sums as an extremely large positive number (T). Then a routine search of flow sums for the specified durations at each station is made for the sequence, and results are printed out. Since this routine is used for reconstituted flows as well as for generated flows, a transfer indicator is used to determine whether the next step is back to the reconstitution routine or the generation routine. If the latter, a check is made for the multipass routine. If all passes are not completed, a transfer to section 4 is made. If all passes are completed for this sequence or if the multipass routine is not being

used, a check is made of remaining years to be generated. If greater than zero, a transfer to section [illegible] is made after adjusting years yet to be generated. Otherwise the job is ended and a new job, if any, is started.

RANDOM NUMBER FUNCTION RNGEN

This random number function is for a binary machine and the constants must be computed according to the number of bits in an integer word. The numbers generated are uniformly distributed in the interval 0 to 1.

The function is called from the main program by a statement similar to the following:

```
A = RNGEN (IX)
```

Where A is some floating point variable name and IX is some integer variable name. The argument name IX need not be the same in the main program and the function. The argument must be initialized to zero in the main program. The location of the initializing statement is important and depends on the results desired. If it is desired to have different sets of random numbers for each of several different sets of computations (jobs) that are run sequentially on the same program, then the argument must be initialized at the very beginning of the program and never reinitialized. If it is permissible to use the same sequence of random numbers for each job, the argument must be initialized at the beginning of each job. The advantage of this latter option occurs when one of the jobs must be re-run for some minor reason as the same random numbers will be used and the results will be comparable.

Three constants must be computed by the following equations:

$$\text{Constant one (C1)} = 2^{(B+1)/2} + 3$$

$$\text{Constant two (C2)} = 2^{B} - 1$$

$$\text{Constant three (C3)} = 1./2.^{B}$$

Where: B = number of bits in an <u>integer</u> word

The constants for some of the common computers are listed in the following table:

COMPUTER	SIZE OF INTEGER WORD	CONSTANTS C1	C2	C3
GE 200 Series	19	1027	524287	0.190734863E-05
GE 400 Series	23	4099	8388607	0.119209290E-06
IBM 360 Series	31	65539	2147483647	0.465661287E-09
IBM 7040 and 7090 Series	35	262147	34359738367	0.2910383046E-10
UNIVAC 1108	"	"	"	"
CDC 6000 Series	48	16777219	281474976710655	0.3552713678E-14

EXHIBIT 1

EXHIBIT 2

Crout's Method

One of the best methods for solving systems of linear equations on desk calculating machines was developed by P. D. Crout in 1941. This method is based on the elimination method, with the calculations arranged in systematic order so as to facilitate their accomplishment on a desk calculator. In this method the coefficients and constant terms of the equations are written in the form of a "matrix," which is a rectangular array of quantities arranged in rows and columns.

The method is best explained by an example. Suppose that in a multiple correlation analysis it is required to solve the following system of linear equations to obtain the unknown values of b_2, b_3, b_4 and b_5.

$$\Sigma x_2^2 \; b_2 + \Sigma x_2 x_3 \; b_3 + \Sigma x_2 x_4 \; b_4 + \Sigma x_2 x_5 \; b_5 = \Sigma x_1 x_2$$

$$\Sigma x_2 x_3 \; b_2 + \Sigma x_3^2 \; b_3 + \Sigma x_3 x_4 \; b_4 + \Sigma x_3 x_5 \; b_5 = \Sigma x_1 x_3$$

$$\Sigma x_2 x_4 \; b_2 + \Sigma x_3 x_4 \; b_3 + \Sigma x_4^2 \; b_4 + \Sigma x_4 x_5 \; b_5 = \Sigma x_1 x_4$$

$$\Sigma x_2 x_5 \; b_2 + \Sigma x_3 x_5 \; b_3 + \Sigma x_4 x_5 \; b_4 + \Sigma x_5^2 \; b_5 = \Sigma x_1 x_5$$

For simplicity let us replace the coefficients of the b's by the letters p, q, r and s, and the constant terms by the letter t, using subscripts 1, 2, 3 and 4 to denote the respective equations.

$$p_1 b_2 + q_1 b_3 + r_1 b_4 + s_1 b_5 = t_1$$

$$p_2 b_2 + q_2 b_3 + r_2 b_4 + s_2 b_5 = t_2$$

$$p_3 b_2 + q_3 b_3 + r_3 b_4 + s_3 b_5 = t_3$$

$$p_4 b_2 + q_4 b_3 + r_4 b_4 + s_4 b_5 = t_4$$

A continuous check on the computations as they progress may be obtained by adding to the matrix of the above system a column of u's, such that $u = p + q + r + s + t$. The matrix and check column are written as follows:

$$\begin{vmatrix} p_1 & q_1 & r_1 & s_1 & t_1 & u_1 \\ p_2 & q_2 & r_2 & s_2 & t_2 & u_2 \\ p_3 & q_3 & r_3 & s_3 & t_3 & u_3 \\ p_4 & q_4 & r_4 & s_4 & t_4 & u_4 \end{vmatrix}$$

The elements p_1, q_2, r_3 and s_4 form the "principal diagonal" of the matrix. Examination of the original equations shows that the coefficients are symmetrical about the principal diagonal, i.e., $q_1 = p_2$, $r_1 = p_3$, $r_2 = q_3$, $s_1 = p_4$, $s_2 = q_4$, and $s_3 = r_4$.
This is characteristic of the system of equations to be solved in any multiple correlation analysis. Because of this symmetry, the computations are considerably simplified. While the Crout method may be used to solve any system of linear equations, the computational steps given here are applicable only to those with symmetrical coefficients.

The solution consists of two parts, viz., the computation of a "derived matrix" and the "back solution." Let the derived matrix be denoted as follows:

$$\begin{vmatrix} P_1 & Q_1 & R_1 & S_1 & T_1 & U_1 \\ P_2 & Q_2 & R_2 & S_2 & T_2 & U_2 \\ P_3 & Q_3 & R_3 & S_3 & T_3 & U_3 \\ P_4 & Q_4 & R_4 & S_4 & T_4 & U_4 \end{vmatrix}$$

EXHIBIT 2

The elements of the derived matrix are computed as follows:

$$P_1 = p_1 \qquad P_2 = p_2 \qquad P_3 = p_3 \qquad P_4 = p_4$$

$$Q_1 = \frac{q_1}{p_1} \qquad R_1 = \frac{r_1}{p_1} \qquad S_1 = \frac{s_1}{p_1} \qquad T_1 = \frac{t_1}{p_1} \qquad U_1 = \frac{u_1}{p_1}$$

$$Q_2 = q_2 - P_2Q_1 \qquad Q_3 = q_3 - P_3Q_1 \qquad R_2 = \frac{Q_3}{Q_2}$$

$$Q_4 = q_4 - P_4Q_1 \qquad S_2 = \frac{Q_4}{Q_2} \qquad T_2 = \frac{t_2-T_1P_2}{Q_2} \qquad U_2 = \frac{u_2-U_1P_2}{Q_2}$$

$$R_3 = r_3 - Q_3R_2 - P_3R_1 \qquad R_4 = r_4 - Q_4R_2 - P_4R_1 \qquad S_3 = \frac{R_4}{R_3}$$

$$T_3 = \frac{t_3-T_2Q_3-T_1P_3}{R_3} \qquad U_3 = \frac{u_3-U_2Q_3-U_1P_3}{R_3}$$

$$S_4 = s_4 - R_4S_3 - Q_4S_2 - P_4S_1$$

$$T_4 = \frac{t_4-T_3R_4-T_2Q_4-T_1P_4}{S_4} \qquad U_4 = \frac{u_4-U_3R_4-U_2Q_4-U_1P_4}{S_4}$$

The general pattern of the above computations, which may be applied to a system containing any number of equations, is as follows:

(1) The first column of the derived matrix is copied from the first column of the given matrix.

(2) The remaining elements in the first row of the derived matrix are computed by dividing the corresponding elements in the first row of the given matrix by the first element in that row.

(3) After completing the $n^{\underline{th}}$ row, the remaining elements in the $(n+1)^{\underline{th}}$ column are computed. Such an element (X) equals the corresponding element of the given matrix minus the product of the element immediately to the left of (X) by the element immediately above the principal diagonal in the same column as (X), minus the product of the second element to the left of (X) by the second element above the principal diagonal in the same column as (X), etc. After each element below the principal diagonal is recorded, and while that element is still in the calculator, it is divided by the element of the principal diagonal which is in the same column. The quotient is the element whose location is symmetrical to (X) with respect to the principal diagonal.

(4) When the elements in the $(n+1)^{\underline{th}}$ column and their symmetrical counterparts have been recorded, the $(n+1)^{\underline{th}}$ row will be complete except for the last two elements, which are next computed. Such an element (X) equals the corresponding element of the given matrix minus the product of the element immediately above (X) by the element immediately to the left of the principal diagonal in the same row as (X), minus the product of the second element above (X) by the second element to the left of the principal diagonal in the same row as (X), etc., all divided by the element of the principal diagonal in the same row as (X).

The check column (U) of the derived matrix serves as a continuous check on the computations in that each element in the column equals one plus the sum of the elements in the same row to the right of the principal diagonal. That is,

$$U_1 = 1 + Q_1 + R_1 + S_1 + T_1$$

$$U_2 = 1 + R_2 + S_2 + T_2$$

$$U_3 = 1 + S_3 + T_3$$

$$U_4 = 1 + T_4$$

This check should be made after completing each row.

The elements of the derived matrix to the right of the principal diagonal form a system of equations which may now be used to compute the unknown values of b_2, b_3, b_4 and b_5 by successive substitution. This is known as the "back solution." The computations are as follows:

$$b_5 = T_4$$

$$b_4 = T_3 - S_3 b_5$$

$$b_3 = T_2 - S_2 b_5 - R_2 b_4$$

$$b_2 = T_1 - S_1 b_5 - R_1 b_4 - Q_1 b_3$$

It is very important that the computations be carried to a sufficient number of digits, both in computing the coefficients and constant terms of the original equations, and in computing the elements of the derived matrix. It is possible for relatively small errors in the coefficients and constant terms of the original equations to result in relatively large errors in the computed solutions of the unknowns. The

greatest source of error in computing the elements of the derived matrix arises from the loss of leading significant digits by subtraction. This must be guarded against and can be done by carrying the computations to more figures than the data. As a general rule, it is recommended that the coefficients and constant terms of the original equations be carried to a sufficient number of decimals to produce at least five significant digits in the smallest quantity, and that the elements of the derived matrix be carried to one more decimal than this, but to not less than six significant digits.

EXHIBIT 2

```
A                    TEST DATA - 723-X6-L2340
A              MONTHLY STREAMFLOW SIMULATION - NOV 1970
A                 STANDARD ANALYSIS AND GENERATION
B   1904      10       1       5       10       5       1
C      1
D      3     107      110     111
E      3      1.       1.      1.
H1071905 4.64  2.24  3.74  9.72 30.2  36.5  13.8  14.8   4.36  1.48   .553  .085
H1071906  .372 1.35  2.25 33.2  16.7  84.2  33.1  18.3  10.7   3.24  1.09   .400
H1071907  .867 1.98 31.4  72.6  32.5  121.  32.4  12.2   6.49  2.80  1.19  1.15
H1101904 2.72  4.08  3.38  3.65 13.2  46.7  62.5 141.   70.2  14.1   6.76  7.14
H1101905 33.5  6.49  5.50  6.89 14.0  34.4  47.5  88.5  82.7  18.4   4.52  2.61
H1101906 2.59  3.31  5.04 48.9  23.1 152.  110.  200.  288.  216.   42.6  12.3
H1101907 6.40  6.07 14.1  25.6  33.4  64.0 118.  122.  124.   64.6  16.1   5.60
H1101908 7.07  6.37 12.3  12.8  18.8  37.1  48.0  55.5  36.2  11.4   5.44  5.01
H1111904 12.4  13.9  13.1  12.5  37.4 134.  212.  590.  431.  123.   65.2  42.7
H1111905 119.  37.7  22.6  28.1  50.8 116.  165.  366.  386.  116.   28.3  12.6
H1111906 11.2  12.1  16.3 146.   68.3 330.  287.  682. 1010. 1000.  270.   67.2
H1111907 31.4  23.4  43.0  87.9 101.  248.  403.  563.  625.  454.  121.   32.5
I
A                    TEST DATA - 723-X6-L2340
A              MONTHLY STREAMFLOW SIMULATION - NOV 1970
A              MULTI-PASS RECONSTITUTION AND GENERATION
B   1904      10       1       5       10       5       2
C
H1071905 4.64  2.24  3.74  9.72 30.2  36.5  13.8  14.8   4.36  1.48   .553  .085
H1071906  .372 1.35  2.25 33.2  16.7  84.2  33.1  18.3  10.7   3.24  1.09   .400
H1071907  .867 1.98 31.4  72.6  32.5  121.  32.4  12.2   6.49  2.80  1.19  1.15
H1101904 2.72  4.08  3.38  3.65 13.2  46.7  62.5 141.   70.2  14.1   6.76  7.14
H1101905 33.5  6.49  5.50  6.89 14.0  34.4  47.5  88.5  82.7  18.4   4.52  2.61
H1101906 2.59  3.31  5.04 48.9  23.1 152.  110.  200.  288.  216.   42.6  12.3
H1101907 6.40  6.07 14.1  25.6  33.4  64.0 118.  122.  124.   64.6  16.1   5.60
H1101908 7.07  6.37 12.3  12.8  18.8  37.1  48.0  55.5  36.2  11.4   5.44  5.01
I
J      1     110
H1111904 12.4  13.9  13.1  12.5  37.4 134.  212.  590.  431.  123.   65.2  42.7
H1111905 119.  37.7  22.6  28.1  50.8 116.  165.  366.  386.  116.   28.3  12.6
H1111906 11.2  12.1  16.3 146.   68.3 330.  287.  682. 1010. 1000.  270.   67.2
H1111907 31.4  23.4  43.0  87.9 101.  248.  403.  563.  625.  454.  121.   32.5
I
```

```
A                        TEST DATA - 723-X6-L2340
A                MONTHLY STREAMFLOW SIMULATION - NOV 1970
A                            FLOW PROJECTIONS
B   1904       10        1        5                        1
C                                           2     1909      10     1913
H1101904  2.72  4.08  3.38  3.65 13.2  46.7  62.5 141.   70.2  14.1   6.76  7.14
H1101905 33.5   6.49  5.50  6.89 14.0  34.4  47.5  88.5  82.7  18.4   4.52  2.61
H1101906  2.59  3.31  5.04 48.9  23.1 152.  110.  200.  288.  216.   42.6  12.3
H1101907  6.40  6.07 14.1  25.6  33.4  64.0 118.  122.  124.   64.6  16.1   5.60
H1101908  7.07  6.37 12.3  12.8  18.8  37.1  48.0  55.5  36.2  11.4   5.44  5.01
H1111904  12.4  13.9  13.1  12.5  37.4 134.  212.  590.  431.  123.   65.2  42.7
H1111905 119.   37.7  22.6  28.1  50.8 116.  165.  366.  386.  116.   28.3  12.6
H1111906  11.2  12.1  16.3 146.   68.3 330.  287.  682. 1010. 1000.  270.   67.2
H1111907  31.4  23.4  43.0  87.9 101.  248.  403.  563.  625.  454.  121.     -1
I
A                        TEST DATA - 723-X6-L2340
A                MONTHLY STREAMFLOW SIMULATION - NOV 1970
A                 COMPUTE AND USE GENERALIZED STATISTICS
B   1904       10        1        5       10      10       1
C                                 2
H1101904  2.72  4.08  3.38  3.65 13.2  46.7  62.5 141.   70.2  14.1   6.76  7.14
H1101905 33.5   6.49  5.50  6.89 14.0  34.4  47.5  88.5  82.7  18.4   4.52  2.61
H1101906  2.59  3.31  5.04 48.9  23.1 152.  110.  200.  288.  216.   42.6  12.3
H1101907  6.40  6.07 14.1  25.6  33.4  64.0 118.  122.  124.   64.6  16.1   5.60
H1101908  7.07  6.37 12.3  12.8  18.8  37.1  48.0  55.5  36.2  11.4   5.44  5.01
H1111904  12.4  13.9  13.1  12.5  37.4 134.  212.  590.  431.  123.   65.2  42.7
H1111905 119.   37.7  22.6  28.1  50.8 116.  165.  366.  386.  116.   28.3  12.6
H1111906  11.2  12.1  16.3 146.   68.3 330.  287.  682. 1010. 1000.  270.   67.2
H1111907  31.4  23.4  43.0  87.9 101.  248.  403.  563.  625.  454.  121.   32.5
I
A                        TEST DATA - 723-X6-L2340
A                MONTHLY STREAMFLOW SIMULATION - NOV 1970
A                          STATISTICS FURNISHED
B              10                         10      10                            3
C
 107 107  .864  .949  .521  .402  .000  .000  .916  .000  .000  .947  .880  .897
 107 110  .390  .951  .532  .407  .000  .999  .867  .000  .998  .936  .850  .754
 107 111  .390  .956  .510  .392 0.     .967  .946 0.     .926  .955  .863  .769
 110 107  .998  .979  .988  .793  .000  .770  .992  .000  .988  .965  .822  .596
 110 107  .866  .928  .518  .317  .999  .000  .923  .833  .000  .983  .963  .729
```

```
110 110  .391  .930  .529  .321  .793  .757  .860  .826  .986  .971  .959  .833
110 111  .391  .936  .507  .309  .789  .733  .938  .763  .915  .975  .974  .850
111 107  .992  .979  .968  .784  .000  .866  .917  .000  .992  .980  .858  .591
111 110  .994  .957  .963  .995  .967  .917  .924  .924  .980  .985  .980  .998
111 107  .861  .970  .538  .315  .968  .000  .999  .906  .000  .968  .974  .728
111 110  .389  .971  .550  .319  .767  .826  .795  .899  .990  .956  .940  .832
111 111  .388  .977  .526  .307  .763  .799  .867  .831  .918  .974  .955  .849
    107  .123  .277  .917 1.378 1.449 1.851 1.393 1.156  .778  .327 -.079 -.529
    107  .509  .100  .651  .339  .151  .196  .154  .076  .176  .152  .138  .412
    107  .015 -.027  .157 -.211 -.750 -.829 -.658 -.164 -.098 -.643 -.793 -.253
    107    .0    .0    .1    .5    .3   1.0    .3    .2    .1    .0    .0    .0
    110  .817  .712  .849 1.132 1.291 1.760 1.859 2.052 1.983 1.538 1.021  .768
    110  .443  .131  .263  .437  .164  .259  .189  .208  .327  .528  .399  .241
    110  .220 -.036 -.048  .150  .418  .586  .262 -.006  .236  .550  .464  .307
    110    .1    .1    .1    .2    .2    .8    .9   1.5   1.4    .8    .2    .1
    111 1.529 1.332 1.401 1.637 1.798 2.281 2.407 2.707 2.712 2.345 1.878 1.574
    111  .451  .207  .242  .416  .160  .184  .143  .118  .195  .469  .391  .283
    111  .289  .505  .359  .118  .073  .144 -.099 -.253  .125  .274 -.074 -.115
    111    .5    .3    .3    .8    .8   2.5   3.2   6.6   7.4   5.1   1.5    .5
A                          TEST DATA - 723-X6-L2340
A                   MONTHLY STREAMFLOW SIMULATION - NOV 1970
A                      GENERALIZED STATISTICS FURNISHED
B          10                                  10      10                        3
C                          1
 107 107  .531
 110 107  .741
 110 110  .763
 111 107  .744
 111 110  .965
 111 111  .763
     107 1.494 -.189  .290    4.    10.
     110 1.965  .766  .299    6.    11.
     111 2.611 1.427  .269    6.    12.

A
```

TEST DATA - 723-X6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
STANDARD ANALYSIS AND GENERATION

IYRA	IMNTH	IANAL	MXRCS	NYRG	NYMXG	NPASS	IPCHQ	IPCHS	NSTA	NCOMB	NTNDM	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
1964	10	1	5	10	5	1	-0	-0	-0	1	-0	-0	-0	-0	-0	-0	-0

COMB 1	STA	3	107	110	111
	RATIO		1.000	1.000	1.000

MAXIMUM VOLUMES OF RECORDED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	5	2	31	73	33	121	33	18	11	3	1	1	121	302	-99999998	18
110	34	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	-99999998	204
996	157	46	89	228	167	566	553	900	1309	1219	314	80	1309	4738	-99999998	299

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	2	10	17	37	14	12	4	1	1	0	0	0	99999999	
110	3	3	3	4	13	34	48	56	36	11	5	3	3	36	2519	
111	11	12	13	13	37	116	165	366	386	116	28	13	11	196	99999999	
996	14	17	24	45	95	187	226	469	473	136	33	15	14	239	99999999	

FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.112	.283	.820	1.465	1.410	1.862	1.395	1.177	.834	.395	.000	-.312
	STD DEV	.513	.108	.597	.433	.157	.263	.214	.087	.192	.173	.162	.415
	SKEW	1.041	-1.308	1.491	-.627	-1.653	-1.073	-1.728	.144	.348	-1.489	-1.641	-.122
	INCRMT	.10	.10	.12	.39	.26	.81	.26	.15	.10	.10	.10	.10
	YEARS	3	3	3	3	3	3	3	3	3	3	3	3
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
	YEARS	5	5	5	5	5	5	5	5	5	5	5	5
111	MEAN	1.439	1.298	1.335	1.673	1.784	2.281	2.407	2.734	2.760	2.462	1.953	1.524
	STD DEV	.469	.223	.223	.473	.182	.213	.166	.115	.187	.449	.408	.302
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39
	YEARS	4	4	4	4	4	4	4	4	4	4	4	4

FREQUENCY STATISTICS AFTER ADJUSTMENTS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.012	.26[illegible]	.769	1.4[illegible]	1.41[illegible]	1.826	1.321	1.177	.719	.316	-.033	-.312
	STD DEV	[illegible]	[illegible]	[illegible]	.303	.157	.227	.137	.087	.228	.166	.133	.415
	SKEW	1.[illegible]41	-1.3[illegible]	1.491	-.627	-1.653	-1.373	-1.728	.144	.348	-1.489	-1.641	-.122
	INCRMT	.10	.10	.12	.39	.26	.81	.26	.15	.10	.10	.10	.10
110	MEAN	.315	.715	.849	1.130	1.290	1.758	1.856	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.435	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.448	1.334	1.385	1.609	1.782	2.250	2.372	2.681	2.693	2.368	1.890	1.507
	STD DEV	.407	.209	.224	.409	.158	.198	.163	.153	.220	.441	.380	.265
	SKEW	1.117	.62[illegible]	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.998	.987
110	.998	1.000	.997
111	.987	.997	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	-4.000	.534	.526
110	.965	.588	.578
111	-4.000	.663	.656

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.970	1.000
110	.970	1.000	.974
111	1.000	.974	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	.964	.98[illegible]	.994
110	.870	.881	.944
111	.964	.982	.994

NOTE: *Remaining months not shown.*

RECORDEC AND RECONSTITUTED FLOWS

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1904	0E	2E	1E	15E	24E	48E	20E	11E	4E	2E	1E	0E	128
107	1905	5	2	4	10	30	36	14	15	4	1	1	0	122
107	1906	0	1	2	33	17	84	33	18	11	3	1	0	263
107	1907	1	2	31	73	32	121	32	12	6	3	1	1	315
107	1908	1E	2E	16E	46E	32E	56E	15E	13E	2E	1E	1E	0E	185

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1904	3	4	3	4	13	47	62	141	70	14	7	7	375
110	1905	33	0	5	7	14	34	47	88	83	18	5	3	343
110	1906	3	3	5	49	23	152	110	200	288	216	43	12	1104
110	1907	6	6	14	26	33	64	118	122	124	65	16	6	600
110	1908	7	6	12	13	19	37	48	55	36	11	5	5	254

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1904	12	14	13	12	37	134	212	590	431	123	65	43	1686
111	1905	119	38	23	28	51	116	165	366	386	116	28	13	1449
111	1906	11	12	16	146	68	330	287	682	1010	1000	270	67	3899
111	1907	31	23	43	88	101	248	403	563	625	454	121	32	2732
111	1908	30E	24E	40E	51E	64E	107E	149E	294E	269E	70E	48E	29E	1175

ADJUSTED FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.019	.278	.761	1.451	1.424	1.807	1.336	1.141	.712	.313	.009	-.314
	STD DEV	.412	.086	.575	.350	.122	.202	.176	.082	.233	.172	.116	.294
	SKEW	1.185	-.585	.399	-.251	-1.298	.445	.192	1.018	.135	.335	-1.606	-.061
	INCRMT	.10	.10	.12	.39	.26	.81	.26	.15	.10	.10	.10	.10
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.035	.220	.071	.626	1.454	.371	-.453	.465	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.447	1.314	1.388	1.682	1.789	2.232	2.361	2.683	2.696	2.344	1.902	1.512
	STD DEV	.407	.197	.227	.410	.158	.215	.176	.152	.216	.470	.372	.263
	SKEW	.964	.188	.070	-.335	.094	.677	.580	-.629	.541	.722	.545	-.671
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

CONSISTENT CORRELATION MATRIX FOR MONTH 10

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.997	.989
110	.997	1.000	.997
111	.989	.997	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	.463	.526	.516
110	.458	.588	.576
111	.481	.660	.651

CONSISTENT CORRELATION MATRIX FOR MONTH 11

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.960	.999
110	.960	1.000	.954
111	.999	.954	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	.964	.975	.985
110	.667	.881	.904
111	.969	.980	.990

NOTE: Remaining months not shown.

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	5	2	31	73	32	121	33	18	11	3	1	1	121	302	954	16
110	33	6	14	49	33	152	118	20C	288	216	43	12	288	1009	2656	45
111	119	38	43	146	1C1	33C	403	682	101C	100C	270	67	1C1C	3579	1C826	182
996	157	46	88	228	167	566	553	900	1309	1219	314	80	1309	4738	14411	243

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	C	1	1	1C	17	36	14	11	2	1	1	C	0	6	869	
110	3	3	3	4	13	34	47	55	36	11	5	3	3	36	2564	
111	11	12	13	12	37	107	149	294	269	70	28	13	11	196	10220	
996	14	17	18	31	74	167	212	362	308	83	33	15	14	239	13726	

INCONSISTENT CORREL MATRIX FOR I= 1 K= 2 DTRMC= 1.001

INCONSISTENT CORREL MATRIX ADJUSTED 0 1 3 1.000

GENERATED FLOWS FOR PERIOD 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1	1	2	4	12	37	28	8	11	2	1	1	0	107
107	2	0	2	3	9	12	43	17	13	9	2	1	0	111
107	3	0	2	9	49	24	64	31	15	9	3	1	0	207
107	4	1	2	11	36	28	61	22	15	9	3	1	0	189
107	5	1	2	1	6	27	50	16	11	3	1	1	0	119

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1	7	5	6	3	11	25	28	55	36	10	4	5	195
110	2	3	4	5	22	15	40	56	184	200	41	9	6	585
110	3	3	5	9	30	22	96	103	154	226	125	29	15	817
110	4	8	6	9	13	19	50	69	162	228	112	16	6	698
110	5	6	5	3	4	14	49	58	84	50	9	4	2	288

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1	26	22	22	11	40	60	124	254	237	62	32	30	920
111	2	13	14	18	80	46	132	190	698	836	337	71	34	2469
111	3	13	16	26	100	75	287	290	575	741	552	245	81	3003
111	4	39	28	34	51	63	163	214	615	781	572	109	34	2703
111	5	25	19	13	13	44	109	213	420	308	77	22	6	1269

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	1	2	11	49	37	64	31	15	9	3	1	0	64	192	724	12
110	8	6	9	30	22	96	103	184	228	125	29	15	228	731	2555	43
111	39	28	34	100	75	287	290	698	836	572	245	81	836	2691	10255	173
996	47	36	54	178	121	447	424	895	1046	687	275	96	1046	3545	13522	228

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	2	1	6	12	28	8	11	2	1	1	0	0	6	648	
110	3	4	3	3	11	25	28	55	36	9	4	2	2	31	2427	
111	13	14	13	11	40	60	124	254	237	62	22	6	6	149	9506	
996	16	20	17	23	74	113	160	320	275	73	26	8	8	207	12648	

GENERATED FLOWS FOR PERIOD 2

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	6	0	1	1	15	16	77	34	18	7	3	1	1	174
107	7	9	2	145	160	35	79	20	15	5	2	1	0	473
107	8	0	1	8	48	26	65	20	11	4	1	1	0	185
107	9	1	2	3	20	25	51	24	13	3	2	1	0	145
107	10	1	2	20	61	23	115	33	13	8	3	1	0	280

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	6	2	3	3	20	22	106	113	124	151	72	27	12	655
110	7	64	8	33	28	25	42	66	106	90	32	10	6	510
110	8	2	4	9	21	21	47	71	114	63	12	6	4	374
110	9	4	5	5	9	18	84	79	94	55	38	7	6	404
110	10	5	7	13	19	27	87	122	169	197	146	26	11	829

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	6	9	11	9	64	63	292	325	542	641	438	218	68	2680
111	7	207	48	92	102	85	146	189	476	470	198	87	34	2134
111	8	9	11	25	72	68	149	243	508	396	104	50	26	1661
111	9	17	17	20	34	57	211	249	385	337	174	53	33	1587
111	10	23	23	39	71	69	284	373	672	784	675	199	62	3274

MAXIMUM VOLUMES FOR PERIOD 2 OF 5 YEARS OF SYNTHETIC FLOWS .

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	9	2	145	160	35	115	34	18	8	3	1	1	160	454	1254	21
110	64	8	33	28	27	106	122	159	197	146	27	12	197	748	2707	46
111	207	48	92	102	85	292	373	672	784	675	218	68	784	2987	11121	189
996	280	59	270	289	145	485	528	855	990	824	246	81	990	3908	15054	256

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	1	15	16	51	20	11	3	1	1	0	0	8	1150	
110	2	3	3	9	18	42	66	94	55	12	6	4	2	33	2216	
111	9	11	9	34	57	146	189	385	337	104	50	26	9	163	8936	
996	11	15	12	63	100	261	275	492	395	118	56	30	11	223	12386	

TEST DATA - 723-X6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
MULTI-PASS RECONSTITUTION AND GENERATION

IYRA	IMNTH	IANAL	MXRCS	NVRG	NYMXG	NPASS	IPCHQ	IPCHS	NSTA	NCOMB	NTNOM	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
1904	10	1	5	10	5	2	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0

MAXIMUM VOLUMES OF RECORDED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	5	2	31	73	33	121	33	18	11	3	1	1	121	302	-99999998	18
110	34	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	2	10	17	37	14	12	4	1	1	0	0	6	99999999	
110	3	3	3	4	13	34	48	56	36	11	5	3	3	36	2519	

FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.112	.283	.820	1.465	1.410	1.862	1.395	1.177	.834	.395	.000	-.312
	STD DEV	.513	.108	.597	.433	.157	.263	.214	.087	.192	.173	.162	.415
	SKEW	1.041	-1.308	1.491	-.627	-1.653	-1.073	-1.728	.144	.348	-1.489	-1.641	-.122
	INCRMT	.10	.10	.12	.39	.26	.81	.26	.15	.10	.10	.10	.10
	YEARS	3	3	3	3	3	3	3	3	3	3	3	3
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
	YEARS	5	5	5	5	5	5	5	5	5	5	5	5

FREQUENCY STATISTICS AFTER ADJUSTMENTS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.012	.283	.769	1.403	1.410	1.862	1.321	1.177	.710	.316	-.033	-.312
	STD DEV	.409	.089	.637	.363	.157	.263	.187	.087	.228	.166	.133	.415
	SKEW	1.041	-1.308	1.491	-.627	-1.653	-1.073	-1.728	.144	.348	-1.489	-1.641	-.122
	INCRMT	.10	.10	.12	.39	.26	.81	.26	.15	.10	.10	.10	.10
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	107	110	
			WITH CURRENT MONTH
107	1.000	.998	
110	.998	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
107	-4.030	.534	
110	.905	.588	

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	107	110	
			WITH CURRENT MONTH
107	1.000	.970	
110	.970	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
107	.964	.980	
110	.870	.881	

NOTE: Remaining months not shown.

RECORDED AND RECONSTITUTED FLOWS
PASS 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1904	0E	2E	1E	12E	27E	68E	20E	11E	4E	2E	1E	0E	148
107	1905	5	2	4	10	30	36	14	15	4	1	1	0	122
107	1906	0	1	2	33	17	84	33	18	11	3	1	0	203
107	1907	1	2	31	73	32	121	32	12	6	3	1	1	315
107	1908	1E	2E	20E	44E	24E	84E	16E	17E	3E	1E	1E	0E	213
STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1904	3	4	3	4	13	47	62	141	70	14	7	7	375
110	1905	33	6	5	7	14	34	47	88	83	18	5	3	343
110	1906	3	3	5	49	23	152	110	200	288	216	43	12	1104
110	1907	6	6	14	26	33	64	118	122	124	65	16	6	600
110	1908	7	6	12	13	19	37	48	55	36	11	5	5	254

ADJUSTED FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
107	MEAN	.019	.285	.768	1.427	1.408	1.870	1.342	1.167	.707	.318	-.037	-.453
	STD DEV	.412	.085	.586	.365	.113	.189	.172	.091	.230	.166	.144	.424
	SKEW	1.185	-.822	.383	-.144	-1.182	-.994	.140	-.143	.453	.436	-.327	-.071
	INCRMT	.10	.10	.12	.39	.26	.31	.26	.15	.10	.10	.10	.10
110	MEAN	.315	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.494	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.855	.220	.071	.625	1.454	.371	-.453	.483	1.341	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10

CONSISTENT CORRELATION MATRIX FOR MONTH 10

STA	107	110	
			WITH CURRENT MONTH
107	1.000	.997	
110	.997	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
107	.481	.526	
110	.475	.588	

CONSISTENT CORRELATION MATRIX FOR MONTH 11

STA	107	110	
			WITH CURRENT MONTH
107	1.000	.972	
110	.972	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
107	.941	.950	
110	.867	.881	

NOTE: ***Remaining months not shown.***

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	5	2	31	73	32	121	33	18	11	3	1	1	121	302	1000	17
110	33	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	1	10	17	36	14	11	3	1	1	0	0	6	894	
110	3	3	3	4	13	34	47	55	36	11	5	3	3	36	2564	

INCONSISTENT CORREL MATRIX FOR I= 1 K= 2 DTRMC= 1.000

PASS 2
STA(S) FROM PREVIOUS PASSES 110

MAXIMUM VOLUMES OF RECORDED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	119	33	43	146	101	33[illegible]	403	682	1010	1000	270	67	1310	3579	-99999998	204

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	11	12	13	13	37	116	165	366	386	116	28	13	11	196	99999999	

FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
111	MEAN	1.439	1.298	1.335	1.673	1.784	2.281	2.407	2.734	2.760	2.462	1.953	1.524
	STD DEV	[illegible]	.223	.223	.473	.182	.213	.166	.115	.187	.449	.408	.302
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39
	YEARS	4	4	4	4	4	4	4	4	4	4	4	4

FREQUENCY STATISTICS AFTER ADJUSTMENTS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	[illegible]
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.465	1.041	1.085	-.121
	INCRMT	.10	[illegible]	.10	.20	.20	.67	.77	1.21	[illegible]	.65	.15	.10
111	MEAN	1.448	1.334	1.385	1.669	1.782	2.259	2.372	2.681	2.693	2.368	1.690	1.567
	STD DEV	.407	.209	.224	.409	.158	.198	.163	.153	.220	.441	.380	.265
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.997	
111	.997	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.588	.573	
111	.663	.656	

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.974	
111	.974	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.881	.944	
111	.982	.994	

NOTE: *Remaining months not shown.*

RECORDED AND RECONSTITUTED FLOWS
PASS 2

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1904	12	14	13	12	37	134	212	590	431	123	65	43	1686
111	1905	119	38	23	28	51	116	165	366	386	116	28	13	1449
111	1906	11	12	16	146	68	330	287	682	1010	1000	270	67	3899
111	1907	31	23	43	88	101	248	403	563	625	454	121	32	2732
111	1908	34E	23E	35E	47E	52E	137E	180E	256E	313E	95E	33E	29E	1234

ADJUSTED FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
111	MEAN	1.458	1.312	1.378	1.674	1.771	2.254	2.378	2.671	2.709	2.369	1.870	1.512
	STD DEV	.409	.196	.216	.409	.163	.195	.158	.173	.198	.441	.399	.263
	SKEW	.320	.239	.089	-.243	.615	.737	.611	-.878	.898	.896	.578	-.674
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

CONSISTENT CORRELATION MATRIX FOR MONTH 10

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.996	
111	.996	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.588	.578	
111	.653	.642	

CONSISTENT CORRELATION MATRIX FOR MONTH 11

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.949	
111	.949	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.881	.920	
111	.981	.994	

NOTE: *Remaining months not shown.*

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	10890	183

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	11	12	13	12	37	116	165	256	313	95	28	13	11	196	10264	

GENERATED FLOWS FOR PERIOD 1
PASS 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1	2	2	11	67	25	67	25	19	6	3	1	1	229
107	2	2	2	18	54	29	133	36	15	9	3	1	2	304
107	3	0	1	0	7	24	119	42	17	11	3	1	0	225
107	4	1	2	93	101	25	103	16	14	4	2	1	0	362
107	5	1	2	3	28	25	100	28	15	5	2	1	0	210

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1	14	6	10	30	20	55	75	135	106	82	47	6	586
110	2	12	6	12	32	32	110	123	183	201	89	12	2	814
110	3	2	3	2	12	19	143	140	237	267	111	33	13	982
110	4	10	7	23	29	24	31	51	64	65	20	7	4	335
110	5	8	5	5	41	24	79	91	150	91	23	9	5	531

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF SYNTHETIC FLOWS

STA	1C	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	2	2	93	101	29	133	42	19	11	3	1	2	133	352	1318	22
110	14	7	23	41	32	143	140	237	267	111	47	13	267	931	3180	54

MINIMUM VOLUMES

STA	1C	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	C	1	0	7	24	67	16	14	4	2	1	C	0	8	1156	
110	2	3	2	12	19	31	51	64	65	20	7	2	2	34	2955	

GENERATED FLOWS FOR PERIOD 1
PASS 2

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1	56	28	33	103	62	188	275	538	565	435	433	37	2753
111	2	52	29	37	107	84	302	343	690	757	529	81	1C	3021
111	3	9	12	9	40	52	262	453	837	1182	586	238	73	3753
111	4	50	30	60	104	70	115	181	331	373	135	55	20	1524
111	5	34	23	20	127	57	239	257	577	397	156	83	31	2001

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	56	30	60	127	84	302	453	837	1182	586	433	73	1182	3556	12738	218

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	9	12	9	40	52	115	181	331	373	135	55	1C	9	131	11751	

GENERATED FLOWS FOR PERIOD 2
PASS 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	6	1	2	7	29	14	83	18	12	3	2	1	0	172
107	7	1	2	5	23	24	89	36	18	18	6	2	1	225
107	8	2	2	2	5	22	22	14	16	4	2	1	0	92
107	9	0	1	2	24	22	64	18	15	2	1	1	0	150
107	10	0	1	3	31	19	57	15	15	3	1	1	0	146

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	6	6	6	7	21	16	37	61	84	54	14	8	8	322
110	7	6	6	6	18	18	96	115	164	534	783	335	21	2102
110	8	19	6	4	2	9	40	45	95	74	28	9	6	337
110	9	2	4	4	15	16	42	55	65	34	9	3	3	252
110	10	3	4	6	30	17	34	48	91	54	11	4	4	306

MAXIMUM VOLUMES FOR PERIOD 2 OF 5 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	2	2	7	31	24	89	36	18	18	6	2	1	89	208	778	13
110	19	6	7	30	18	96	115	164	534	783	335	21	783	2027	3281	55

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	2	5	14	22	14	12	2	1	1	0	0	6	650	
110	2	4	4	2	9	34	45	65	34	9	3	3	2	27	3149	

GENERATED FLOWS FOR PERIOD 2
PASS 2

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	6	26	22	26	67	56	135	208	390	392	108	60	48	1538
111	7	28	22	24	67	65	252	339	635	1339	2916	2337	100	8124
111	8	96	34	18	6	31	115	157	394	400	182	72	33	1538
111	9	8	11	14	52	42	136	176	316	281	72	22	14	1144
111	10	11	13	18	99	62	131	164	395	379	117	26	22	1437

MAXIMUM VOLUMES FOR PERIOD 2 OF 5 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	96	34	26	99	65	252	339	635	1339	2916	2337	100	2916	7819	13594	230

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
111	8	11	14	6	31	115	157	316	281	72	22	14	6	152	12818	

TEST DATA - T23-X6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
FLOW PROJECTIONS

IYRA	IMNTH	IANAL	NARCS	NYRG	NYMXG	NPASS	IPCHQ	IPCHS	NSTA	NCOMB	NTNUM	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
1904	10	1	5	-0	-0	1	-0	-0	-0	-0	-0	-0	-0	2	1909	10	1913

MAXIMUM VOLUMES OF RECORDED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	34	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	-99999998	207

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	3	3	3	4	13	34	48	56	36	11	5	3	3	36	2519	
111	11	12	13	13	37	116	165	306	386	116	28	13	11	196	99999999	

FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
	YEARS	5	5	5	5	5	5	5	5	5	5	5	5
111	MEAN	1.439	1.298	1.335	1.673	1.784	2.281	2.407	2.734	2.769	2.462	1.953	1.526
	STD DEV	.469	.223	.223	.473	.182	.213	.166	.115	.187	.449	.408	.370
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-1.204
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.41
	YEARS	4	4	4	4	4	4	4	4	4	4	4	3

FREQUENCY STATISTICS AFTER ADJUSTMENTS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.448	1.334	1.385	1.669	1.782	2.250	2.372	2.681	2.693	2.368	1.890	1.499
	STD DEV	.407	.209	.224	.409	.158	.198	.163	.153	.220	.441	.380	.266
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-1.204
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.41

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.997	
111	.997	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.588	.538	
111	.663	.613	

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.974	
111	.974	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.881	.944	
111	.982	.994	

NOTE: Remaining months not shown.

RECORDED AND RECONSTITUTED FLOWS

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1904	3	4	3	4	13	47	62	141	70	14	7	7	375
110	1905	33	6	5	7	14	34	47	88	83	18	5	3	343
110	1906	3	3	5	49	23	152	110	200	288	216	43	12	1104
110	1907	6	6	14	26	33	64	118	122	124	65	16	6	600
110	1908	7	6	12	13	19	37	48	55	36	11	5	5	254
STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1904	12	14	13	12	37	134	212	590	431	123	65	43	1686
111	1905	119	38	23	28	51	116	165	366	386	116	28	13	1449
111	1906	11	12	14	146	68	330	287	682	1010	1000	270	67	3899
111	1907	31	23	43	88	101	248	403	563	625	454	121	33E	2733
111	1908	34E	26E	39E	47E	59E	116E	136E	279E	315E	98E	43E	30E	1222

ADJUSTED FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.20	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.459	1.321	1.386	1.674	1.783	2.240	2.354	2.678	2.709	2.371	1.892	1.518
	STD DEV	.409	.200	.224	.409	.158	.207	.186	.160	.193	.439	.379	.262
	SKEW	.806	.043	.068	-.239	.297	.741	.399	-.725	.906	.908	.581	-.785
	INCRMT	.43	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.41

CONSISTENT CORRELATION MATRIX FOR MONTH 10

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.995	
111	.995	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.588	.531	
111	.652	.596	

CONSISTENT CORRELATION MATRIX FOR MONTH 11

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.967	
111	.967	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.881	.922	
111	.972	.990	

NOTE: Remaining months not shown.

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	33	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	10872	183

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	3	3	3	4	13	34	47	55	36	11	5	3	3	36	2564	
111	11	12	13	12	37	116	136	279	315	98	28	13	11	196	10214	

GENERATED FLOWS FOR PERIOD 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1909	3	5	12	99	37	43	74	124	162	47	26	10	642
110	1910	11	7	19	27	19	131	106	172	241	304	65	12	1114
110	1911	6	6	4	11	36	136	103	267	744	766	123	13	2215
110	1912	11	7	14	79	37	42	66	110	159	35	8	4	572
110	1913	2	3	8	28	16	58	62	120	59	25	13	10	404

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1909	16	17	33	265	95	185	216	480	650	418	197	55	2628
111	1910	52	29	34	99	55	291	293	666	1037	1561	384	69	4590
111	1911	29	23	15	38	81	344	241	833	2588	3593	626	73	8484
111	1912	54	30	45	218	129	182	189	475	642	217	59	27	2267
111	1913	6	9	23	92	49	185	167	474	399	209	129	60	1802

GENERATED FLOWS FOR PERIOD 2

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1909	6	5	9	27	28	59	90	150	118	31	8	4	535
110	1910	6	5	7	34	34	84	116	217	201	65	21	10	800
110	1911	29	8	12	9	16	28	38	45	37	9	4	3	238
110	1912	2	3	4	29	19	53	73	127	161	72	26	11	580
110	1913	19	7	13	4	13	34	57	90	52	11	4	4	308

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1909	26	21	29	96	97	214	248	596	649	225	69	24	2294
111	1910	28	20	23	113	129	329	280	727	631	433	165	60	2938
111	1911	122	42	44	35	52	88	138	257	309	77	30	19	1213
111	1912	10	12	14	99	62	169	238	495	669	519	205	62	2554
111	1913	47	37	46	15	44	114	196	396	346	87	33	21	1422

TEST DATA - 723-X6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
COMPUTE AND USE GENERALIZED STATISTICS

IYRA	IMNTH	IANAL	NARCS	NYRG	NYMXG	NPASS	IPCHQ	IPCHS	KSTA	NCOMB	NTNDM	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
1904	11	1	5	10	10	1	-0	-0	-0	-0	-0	-0	2	-0	-0	-0	-0

MAXIMUM VOLUMES OF RECORDED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	34	6	14	49	33	152	118	200	284	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	-99999998	204

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	3	3	3	4	13	34	48	56	36	11	5	3	3	36	2519	
111	11	12	13	13	37	116	165	366	366	116	28	13	11	196	99999999	

FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.21	.67	.77	1.21	1.20	.65	.15	.10
	YEARS	5	5	5	5	5	5	5	5	5	5	5	5
111	MEAN	1.439	1.298	1.335	1.673	1.784	2.261	2.407	2.734	2.760	2.462	1.953	1.524
	STD DEV	.469	.223	.223	.473	.182	.213	.166	.115	.187	.449	.408	.302
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.44	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39
	YEARS	4	4	4	4	4	4	4	4	4	4	4	4

FREQUENCY STATISTICS AFTER ADJUSTMENTS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.21	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.448	1.334	1.385	1.669	1.782	2.250	2.372	2.681	2.693	2.368	1.890	1.507
	STD DEV	.407	.209	.224	.409	.158	.198	.163	.153	.220	.441	.380	.265
	SKEW	1.117	.620	1.004	-.243	.258	.208	.278	-1.429	.892	.472	-.019	-.939
	INCRMT	.44	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.997	
111	.997	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.548	.578	
111	.663	.656	

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	110	111	
			WITH CURRENT MONTH
110	1.000	.974	
111	.974	1.000	
			WITH PRECEDING MONTH AT ABOVE STATION
110	.841	.944	
111	.982	.994	

NOTE: Remaining months not shown.

RECORDED AND RECONSTITUTED FLOWS

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1904	3	4	3	4	13	47	62	141	70	14	7	7	375
110	1905	33	6	5	7	14	34	47	88	83	18	5	3	343
110	1906	3	3	5	49	23	152	110	200	283	216	43	12	1104
110	1907	6	6	14	26	33	64	118	122	124	65	16	6	600
110	1908	7	6	12	13	19	37	48	55	35	11	5	5	254
STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1904	12	14	13	12	37	134	212	590	431	123	65	43	1686
111	1905	119	38	23	28	51	116	165	366	386	116	28	13	1449
111	1906	11	12	16	146	68	330	287	682	1010	1000	270	67	3899
111	1907	31	23	43	88	101	246	403	563	625	454	121	32	2732
111	1908	30E	25E	39E	48E	59E	131E	153E	216E	253E	117E	48E	29E	1148

ADJUSTED FREQUENCY STATISTICS

STA	ITEM	10	11	12	1	2	3	4	5	6	7	8	9
110	MEAN	.815	.715	.849	1.130	1.290	1.758	1.858	2.051	1.982	1.536	1.020	.770
	STD DEV	.444	.130	.262	.439	.164	.259	.190	.208	.328	.530	.400	.240
	SKEW	1.211	-.835	.220	.071	.626	1.454	.371	-.453	.485	1.041	1.085	-.121
	INCRMT	.10	.10	.10	.20	.21	.67	.77	1.21	1.20	.65	.15	.10
111	MEAN	1.447	1.319	1.386	1.675	1.783	2.250	2.363	2.657	2.691	2.386	1.900	1.513
	STD DEV	.407	.199	.225	.409	.158	.198	.173	.200	.224	.424	.372	.263
	SKEW	.972	.077	.068	-.261	.281	.758	.626	-1.148	.389	.957	.550	-.696
	INCRMT	.44	.22	.24	.69	.64	2.07	2.67	5.50	6.13	4.23	1.21	.39

CONSISTENT CORRELATION MATRIX FOR MONTH 10

WITH CURRENT MONTH

STA	110	111
110	1.000	.997
111	.997	1.000

WITH PRECEDING MONTH AT ABOVE STATION

STA	110	111
110	.588	.578
111	.660	.651

CONSISTENT CORRELATION MATRIX FOR MONTH 11

WITH CURRENT MONTH

STA	110	111
110	1.000	.964
111	.964	1.000

WITH PRECEDING MONTH AT ABOVE STATION

STA	110	111
110	.881	.903
111	.974	.984

NOTE: Remaining months not shown

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTEU FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	33	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	10797	162

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MC	54-MO	AV MO
110	3	3	3	4	13	34	47	55	36	11	5	3	3	36	2564	
111	11	12	13	12	37	116	153	216	253	116	28	13	11	196	10240	

GENERALIZED STATISTICS

ST1	ST2	RAV
110	110	.774
111	110	.981
111	111	.789

STA	AVMX	AVMN	SDAV	MAXMO	MINMO
110	1.964	.767	.300	6	11
111	2.578	1.384	.271	7	12

CONSISTENT CORRELATION MATRIX FOR MONTH 10

WITH CURRENT MONTH

STA	110	111
110	1.000	.981
111	.981	1.000

WITH PRECEDING MONTH AT ABOVE STATION

STA	110	111
110	.924	.853
111	.853	.939

CONSISTENT CORRELATION MATRIX FOR MONTH 11

WITH CURRENT MONTH

STA	110	111
110	1.000	.981
111	.981	1.000

WITH PRECEDING MONTH AT ABOVE STATION

STA	110	111
110	.924	.853
111	.853	.939

NOTE: Remaining months not shown

MAXIMUM VOLUMES FOR PERIOD 1 OF 5 YEARS OF RECORDED AND RECONSTITUTED FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	33	6	14	49	33	152	118	200	288	216	43	12	288	1009	2656	45
111	119	38	43	146	101	330	403	682	1010	1000	270	67	1010	3579	10797	182

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	3	3	3	4	13	34	47	55	36	11	5	3	3	36	2564	
111	11	12	13	12	37	116	153	216	253	116	28	13	11	196	10240	

GENERATED FLOWS FOR PERIOD 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1	6	5	14	29	43	36	74	129	66	31	21	11	465
110	2	11	9	23	45	45	56	85	137	62	27	16	9	525
110	3	9	7	14	34	48	45	187	392	90	19	7	3	855
110	4	5	7	8	12	25	62	61	68	38	25	21	14	346
110	5	17	21	14	7	7	19	50	166	107	48	20	8	484
110	6	6	6	13	26	35	50	65	143	104	48	17	6	519
110	7	10	11	24	56	85	82	101	118	28	11	8	5	539
110	8	4	5	8	23	57	121	211	195	34	9	6	4	677
110	9	4	3	5	10	27	65	106	181	66	23	4	1	495
110	10	2	2	2	3	5	27	38	185	134	60	12	3	473

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1	24	22	29	65	106	106	182	272	543	255	169	92	1865
111	2	43	39	49	103	124	154	222	299	529	208	136	87	1993
111	3	38	31	34	76	121	130	378	774	876	228	78	26	2790
111	4	17	23	22	32	59	137	169	163	313	187	161	83	1366
111	5	54	71	45	25	21	44	109	297	806	448	192	77	2189
111	6	28	26	29	60	90	130	174	294	791	441	173	53	2289
111	7	33	39	50	120	206	232	280	279	277	124	67	45	1754
111	8	18	19	20	49	123	269	500	475	364	95	53	44	2029
111	9	17	15	14	24	59	142	256	385	586	303	57	16	1874
111	10	7	7	5	7	13	51	92	312	975	573	138	31	2211

MAXIMUM VOLUMES FOR PERIOD 1 OF 10 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	17	21	24	56	85	121	211	392	134	60	21	14	392	797	2691	45
111	54	71	50	120	208	269	500	774	975	573	192	92	975	2507	10214	170

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
110	2	2	2	3	5	19	38	68	28	9	4	1	1	14	1935	
111	7	7	5	7	13	44	92	163	277	95	53	16	5	56	7809	

TEST DATA - 723-A6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
STATISTICS FURNISHED

IYRA	IMNTH	IANAL	MXRCS	NYRG	NYMXG	NPASS	IPCHQ	IPCHS	NSTA	NCOMB	NTNUM	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
-0	10	-0	-0	10	10	-0	-0	-0	3	-0	-0	-0	-0	-0	-0	-0	-0

GENERATED FLOWS FOR PERIOD 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1	4	3	237	18	28	77	30	15	10	3	1	1	427
107	2	8	3	236	13	44	22	9	19	4	2	1	0	361
107	3	1	2	19	6	18	61	17	18	8	3	1	0	154
107	4	1	2	21	23	24	74	30	14	7	2	1	0	199
107	5	1	2	15	35	25	89	34	14	10	3	1	1	230
107	6	3	2	10	8	34	67	18	13	5	2	1	0	163
107	7	1	2	25	31	28	111	38	18	7	2	1	0	264
107	8	4	2	43	157	25	106	27	15	6	2	1	0	388
107	9	1	1	2	8	25	47	14	12	4	2	1	0	117
107	10	0	1	4	14	25	75	24	12	4	2	1	0	162

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1	16	8	26	16	20	64	98	224	214	185	31	9	911
110	2	26	8	28	4	9	22	31	63	45	11	5	6	258
110	3	3	4	8	14	17	24	48	145	125	48	15	6	457
110	4	5	6	10	16	19	76	89	131	137	71	18	10	588
110	5	4	4	9	18	22	73	96	191	267	121	20	7	832
110	6	15	5	8	4	17	47	54	90	80	12	5	4	341
110	7	4	4	12	28	29	79	129	126	126	36	13	8	594
110	8	17	8	13	66	28	52	74	107	88	32	10	3	498
110	9	3	4	4	4	14	24	41	73	46	10	6	3	232
110	10	2	3	5	7	20	52	67	83	64	24	6	9	341

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1	70	40	104	47	59	250	284	633	991	1354	169	63	4070
111	2	114	50	100	13	29	69	163	295	297	88	46	42	1336
111	3	13	14	28	33	56	123	209	613	606	305	102	46	2148
111	4	27	21	30	43	70	227	294	507	572	327	168	71	2357
111	5	22	19	36	54	76	222	344	690	843	596	135	47	3084
111	6	65	24	30	13	57	113	208	443	383	130	24	24	1514
111	7	22	17	28	82	103	271	373	643	594	252	109	61	2555
111	8	82	31	42	181	76	217	215	535	492	201	87	19	2178
111	9	18	15	15	15	46	99	177	386	323	88	39	19	1240
111	10	9	13	19	24	71	168	281	363	411	144	46	52	1601

MAXIMUM VOLUMES FOR PERIOD 1 OF 10 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	8	3	237	157	44	111	38	19	10	3	1	1	237	405	1346	21
110	26	8	28	66	29	79	129	224	267	185	31	10	267	816	2951	42
111	114	50	104	181	103	271	373	690	991	1354	169	71	1354	3681	12588	184

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	5	1	2	6	18	22	9	12	4	2	1	0	0	8	751	
110	2	3	4	4	9	22	31	63	45	10	5	3	2	26	1712	
111	9	13	15	13	29	69	163	295	297	88	24	19	9	123	7668	

 EXHIBIT 4

TEST DATA - 723-X6-L2340
MONTHLY STREAMFLOW SIMULATION - NOV 1970
GENERALIZED STATISTICS FURNISHED

IVRA	IMNTH	IANAL	MXRCS	NYRG	NYMXG	NPASS	IPCHQ	IPCHS	NSTA	NCOMB	NTNDX	NCSTY	IGNRL	NPROJ	IYRPJ	MTHPJ	LYRPJ
-0	10	-0	-0	10	10	-0	-0	-0	3	-0	-0	-0	1	-0	-0	-0	-0

INCONSISTENT CORREL MATRIX ADJUSTED 0 1 2 1.194

INCONSISTENT CORREL MATRIX ADJUSTED 0 1 2 1.094

INCONSISTENT CORREL MATRIX ADJUSTED 0 1 2 1.011

RAW CORRELATION COEFFICIENTS FOR MONTH 10

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.741	.744
110	.741	1.000	.965
111	.744	.965	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	.681	.567	.570
110	.567	.913	.838
111	.570	.838	.913

RAW CORRELATION COEFFICIENTS FOR MONTH 11

STA	107	110	111
			WITH CURRENT MONTH
107	1.000	.741	.744
110	.741	1.000	.965
111	.744	.965	1.000
			WITH PRECEDING MONTH AT ABOVE STATION
107	.531	.567	.570
110	.567	.913	.838
111	.570	.838	.913

NOTE: Remaining months not shown

GENERATED FLOWS FOR PERIOD 1

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
107	1	2	9	29	13	31	25	24	10	3	1	1	1	149
107	2	1	3	14	7	53	72	32	24	7	3	1	1	218
107	3	1	2	8	5	9	15	9	13	6	4	0	1	73
107	4	1	4	7	11	20	30	36	13	9	2	1	0	134
107	5	0	2	11	20	25	56	80	22	9	2	1	1	231
107	6	1	1	3	3	22	44	18	5	2	1	0	0	100
107	7	1	1	6	12	27	43	60	37	9	2	1	1	200
107	8	2	2	5	48	30	34	9	8	3	2	1	1	145
107	9	0	1	2	4	14	20	14	5	2	3	1	0	66
107	10	0	2	6	9	20	14	14	5	2	2	1	1	76

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
110	1	14	21	34	34	40	49	94	286	63	25	7	3	670
110	2	3	4	13	13	23	39	147	411	299	129	29	12	1122
110	3	10	10	9	13	20	17	28	200	83	50	16	6	462
110	4	6	8	13	23	37	50	84	166	191	110	47	13	746
110	5	10	7	20	31	39	53	105	273	190	55	15	6	804
110	6	7	6	9	8	22	42	208	238	95	25	5	3	668
110	7	3	2	8	31	72	72	126	268	137	28	16	7	770
110	8	6	10	12	32	40	41	33	105	59	34	20	5	397
110	9	5	4	6	9	15	17	46	97	46	35	20	6	306
110	10	6	5	12	17	27	23	42	51	60	37	12	8	300

STA	YEAR	10	11	12	1	2	3	4	5	6	7	8	9	TOTAL
111	1	57	90	98	105	131	217	356	950	318	183	51	33	2589
111	2	14	22	32	45	89	132	633	1308	1034	708	235	96	4348
111	3	38	80	29	29	62	81	141	661	326	223	109	58	1997
111	4	31	35	34	54	132	221	383	649	619	478	305	97	3038
111	5	45	39	55	95	148	222	546	1259	749	283	105	48	3594
111	6	26	23	25	25	70	104	586	940	326	184	32	30	2371
111	7	16	12	15	64	217	311	576	1462	701	196	111	73	3754
111	8	33	38	33	93	119	158	132	490	272	165	129	42	1704
111	9	24	19	17	27	53	68	191	400	180	172	114	44	1309
111	10	26	29	32	57	106	99	210	190	263	170	91	52	1325

MAXIMUM VOLUMES FOR PERIOD 1 OF 10 YEARS OF SYNTHETIC FLOWS

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	2	9	29	48	53	72	80	37	9	4	1	1	80	216	798	12
110	14	21	34	34	72	72	208	411	299	129	47	13	411	1053	3759	52
111	57	90	98	105	217	311	633	1462	1034	708	305	97	1462	4049	15176	217

MINIMUM VOLUMES

STA	10	11	12	1	2	3	4	5	6	7	8	9	1-MO	6-MO	54-MO	AV MO
107	0	1	2	3	9	14	9	5	2	1	0	0	0	6	513	
110	3	2	6	8	15	17	28	51	46	25	5	3	2	43	2200	
111	14	12	15	25	53	68	132	190	180	165	32	30	12	168	9433	

EXHIBIT 5

DEFINITIONS - 723-X6-L2340

AC1	- Alienation coefficient for station 1
AC2	- Alienation coefficient for station 2
AC3	- Alienation coefficient for station 3
ADJ	- Plus sign indicates value smaller than upstream sum by tandem test
ADJ1	- Equal sign indicates value adjusted by tandem test
ALCFT(I,K)	- Alienation coefficient array
ALOG	- Computer library function of natural logarithm
ANLOG	- Number of logarithms
ANYRS	- Number of years of record
AV(I,K)	- Mean logarithm
AVG(I,K)	- Average of the generated deviates
AVGQ(I)	- Average monthly flow for a station
AVMN(I)	- Average logarithm of flow for minimum 3 consecutive months
AVMX(I)	- Average logarithm of flow for maximum 3 consecutive months
B(L)	- Beta coefficient
BETA(I,K,L)	- Beta coefficient for generation equation
BLANK	- Blank space
CROUT	- Program subroutine to solve simultaneous equations
CSTAC(KX,K)	- Coefficient by which flows are multiplied before adding in a combination
DABS	- Computer library function of absolute value of double precision number
DQ(I,K)	- Increment of flow
DTRMC	- Determination coefficient
E	- Letter E indicates estimated value
FAC	- Temporary factor
I	- Index for calendar month
IA	- Indicator in column 1 of first card for each job
IANAL	- Indicator, positive value calls for analysis
IENDF	- End of file indicator
IGNRL	- Indicator, + 2 calls for computing generalized statistics and + 1 or + 2 calls for using generalized statistics for generating flows
IMN(I)	- Month sequence number of last month of 3 driest consecutive months
IMNTH	- Calendar month number for first month of water year
IMX(I)	- Month sequence number of last month of 3 wettest consecutive months
INDC	- Transfer indicator
IP	- Month number for preceding month
IPASS	- Sequence number of pass (subset of stations)
IPCHQ	- Indicator, positive value calls for writing discharges on tape
IPCHS	- Indicator, positive value calls for punching statistics
IQ(I)	- Fixed-point conversion of flow values

IQTAP	- Tape number for storing flows
IRCON	- Indicator, positive value calls for flow reconstitution
ISKZ	- Positive value calls for varying flow increment (DQ) to make skew zero.
IST(K,L)	- Sequence number of upstream station for tandem test
ISTA(K)	- Station number
ISTAC(KX,K)	- Station number in a combination
ISTAN	- Temporary station number
ISTAP	- Station sequence number for all passes
ISTAT	- Tape number for storing statistics
ISTN(L)	- Station number of downstream tandem station
ISTT(K,L)	- Station number of upstream tandem station
ISTX(L)	- Station number of independent station for consistences test
ISTY(L)	- Station number of dependent station for consistences test
ITEMP	- Temporary variable
ITMP	- Temporary variable
ITMPP	- Temporary variable
ITP	- Temporary variable
ITRNS	- Transfer indicator
IX	- Temporary variation of I
IXX	- Argument for random number function
IYR	- Number of current year
IYRA	- First year of data
IYRPJ	- Year of start of flow projection
J	- Index for year
JA	- Sequence number of projection year
JTMP(L)	- Matrix column number
JTP	- Matrix column number
JX	- Temporary variation of J
JXTMP	- Temporary variation of J
K	- Index for station
KM	- Dimension limit for number of consecutive months
KPASS	- Dimension limit for number of passes
KSTA	- Dimension limit for total number of stations
KSTAC(KX,K)	- Index number of station in a combination
KSTAP	- Dimension limit for total number of stations
KX	- Temporary variation of K or combination sequence
KYR	- Dimension limit for number of consecutive years
L	- Index for related station
LA	- Temporary variation of L
LQTAP	- Number of records up to present position on tape IQTAP
LSTAT	- Number of records up to present position on tape ISTAT
LTMP(L)	- Matrix row number
LTP	- Matrix row number
LTRA	- Letter A
LX	- Temporary variation of L
LYRPJ	- Last year of each projection
M	- Serial number of month
MA	- Sequence number of month of projected flow

MO(I)	- Calendar month number
MPASS	- Temporary counter for number of passes
MTHPJ	- Calendar month of start of each projection
MXRCS	- Number of years in each period for which maximum and minimum recorded and reconstituted flows are desired
N	- Serial number of period of flows
NC	- Counter to prevent continuous looping
NCA	- Counter to prevent continuous looping
NCAB(I,K,L)	- Number of values and cross products used to compute correlation coefficients
NCB	- Transfer indicator
NCOMB	- Number of combinations of stations max. and min. quantities are to be computed
NCSTY	- Number of consistency tests
NINDP	- Number of independent variables in regression study
NJ	- Number of years in computation sequence
NLOG(I,K)	- Number of logarithms used to compute frequency statistics
NMNMX	- Number of months following dry season and preceding wet season
NMXMN	- Number of months following wet season and preceding dry season
NPASS	- Total number of passes in job
NPROJ	- Number of projections of future flows from present conditions
NQ	- Counter for number of flows
NQTAP	- Total number of records saved on tape IQTAP
NSMX(L)	- Number of upstream stations in tandem test
NSTA	- Number of stations in analysis
NSTAA	- NSTA + 1
NSTAC(KX)	- Number of stations in a combination
NSTAT	- Total number of records saved on tape ISTAT
NSTAX	- NSTA + NSTA
NSTNP(I)	- Number of stations in a particular pass
NSTX	- Number of stations in current pass that occurred in preceding passes
NSTXX	- NSTX + 1
NSUM(K)	- Number of stations upstream from a station for tandem test
NTNDM	- Number of tandem tests
NVAR	- Total number of variable in regression study
NYMXG	- Number of years of generated flows in each period for which maximum and minimum flows are desired
NYRG	- Total number of years of generated flows
NYRS	- Number of years of recorded flows
Q(M,K)	- Monthly flow
QM(I)	- Monthly flow
QMIN(I,K)	- Minimum flow
QPREV(I)	- Flow for previous month
QR(M,K)	- Identification symbol
QSTAP(I)	- Temporary storage of QPREV
R(K,L)	- Correlation coefficient in a given matrix
RA(I,K,L)	- Correlation coefficient
RAV(K,L)	- Average correlation coefficient for 12 calendar months

RMAX	- Maximum consistent correlation coefficient
RMIN	- Minimum consistent correlation coefficient
RNGEN(IXX)	- Program random number function
R1	- Correlation coefficient being tested
R2	- Correlation coefficient being tested
R3	- Correlation coefficient being tested
SD(I,K)	- Standard devaition of logarithms for calendar month
SDAV(K)	- Average standard deviation for 12 consecutive months
SDV(I,K)	- Standard deviation of the generated deviates
SKEW(I,K)	- Skew coefficient of logarithms for calendar month
SMQ(J,K)	- Maximum or minimum flow for month or duration
SQA(I,K,L)	- Sum of squares of first variable
SQB(I,K,L)	- Sum of squares of second variable
SUM	- Average correlation coefficient of matrix
SUMA(I,K,L)	- Sum of first variable
SUMB(I,K,L)	- Sum of second variable
T	- Large positive constant
TEMP	- Temporary variable
TMP	- Temporary variable
TMPA	- Temporary variable
TMPB	- Temporarv variable
TMPP	- Temporary variable
TP	- Temporary variable
X(I)	- Value of independent variable in regression equation
XINCR(I)	- Iteration value for flow increment
XPAB(I,K,L)	- Sum of cross products of first and second variables

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C     723-X6-L2340 MONTHLY STREAMFLOW SIMULATION HEC, C OF E, USA  NOV 1970
CA * * * * * * * LIBRARY FUNCTIONS ALOG, DABS      * * * * * * * * * * * * *
C     PROGRAM SUBROUTINE CROUT,RAGEN -- SEE COMMENTS IN HNGEN
C INDEXES I=CALENDAR MONTH J=YEAR K=STA L=RELATED STA M=SUCCESSIVE MONTH
C
      DIMENSION
     ,D(10),R(10,11),
     ,ALCFT(12,10),AV(12,10),AVG(12,10),AVGQ(10),AVMN(10),AVMX(10),
     ,BETA(12,10,10),DQ(12,10),IMN(10),IMX(10),IQ(15),
     ,ISTA(10),JTMP(9),LTMP(10),MO(12),NCAB(12,10,20),
     ,NLOG(12,10),Q(1201,10),QM(12),QMIN(12,10),QPREV(10),QR(1201,10),
     ,QSTAP(100),RA(12,10,20),RAV(10,10),SD(12,10),SDAV(10),SDV(12,10),
     ,SKEW(12,10),SMO(30,10),SQA(12,10,20),SQP(12,12,20),SUMA(12,10,20),
     ,SUMB(12,10,20),X(10),XINCR(12),XPAS(12,10,20),
     ,CSTAC(2,10,5),ISTAC(2,10),ISTN(10),ISTT(10,10),ISTX(10),
     ,ISTY(10),KSTAC(2,10,5),NSMX(10),NSTAC(2,5),NSTNP(5),
     ,NSUM(10,5),MCOMB(5),MTNCH(5),IST(10,10,5)
      DOUBLE PRECISION R,B
      COMMON DTRMC,NINDP,B
      DATA LTRA/1HA/,BLANK/1H /,E/1HE/,ADJ/1H+/,ADJ1/1H=/
   10 FORMAT(1H1)
   20 FORMAT (1X,I5,19I6)
   30 FORMAT(1X,I7,9I8)
   40 FORMAT(1X,A3,9A4,10A4)
   50 FORMAT(1X,I3,I4,12F6.0)
   60 FORMAT(1X,F7.0,9F8.0)
   70 FORMAT (1X,I3,I4,12F6.3)
   80 FORMAT (1X,I7,12F6.3)
   90 FORMAT (1X,I7,12F6.1)
  100 FORMAT(1X,I4,I6,12I8,I10)
  110 FORMAT (A1,A3,9A4,10A4)
  120 FORMAT (1X,I7,3F6.3,2I6)
  130 FORMAT (/23H GENERALIZED STATISTICS//13H ST1 ST2  RAV)
  140 FORMAT(/38H      STA  AVMX  AVMN  SDAV MAXMO MINMO)
      ISTAT=8
      IQTAP=9
      KPASS=5
      KSTAP=100
      KSTA=10
      KYR=100
      KM=KYR*12+1
      NSTA=0
C            WASTE CARDS UNTIL AN A IN COLUMN 1, FIRST TITLE CARD
C                                                       ** CARD A **
  150 READ(5,110) IA,(SMO(M,1),M=1,20)
      IF (IA.NE.LTRA) GO TO 150
      WRITE(6,10)
      READ(5,40)((SMO(M,K),M=1,20),K=2,3)
      WRITE(6,40)((SMO(M,K),M=1,20),K=1,3)
C                                                ** CARD B CARD C **
      READ(5,30)IYRA,IMNTH,IANAL,MXRCS,NYRG,NYMXG,NPASS,IPCHQ,IPCHS,NSTA
     1,NCOMB,NTNOM,NCSTY,IGNHL,NPROJ,IYRPJ,MTHPJ,LYRPJ
C            TERMINATE WITH 5 BLANK CARDS, AN A IN COL 1 OF FIRST
      ITMP=IANAL+NYRG
      IF(ITMP.GT.0)GO TO 180
      STOP
  160 WRITE (6,170) NYRS,NSTA,NCOMB,IPASS
  170 FORMAT (/19H DIMENSION EXCEEDED ,5X,4HNYRS,I4,5X,4HNSTA,I3,5X,
     15HNCOMB,I3,5X,5HIPASS,I3)
      GO TO 150
  180 WRITE(6,190)
  190 FORMAT(/108H  IYRA IMNTH IANAL MXRCS  NYRG NYMXG NPASS IPCHQ IPCHS
     1  NSTA NCOMB NTNOM NCSTY IGNHL NPROJ IYRPJ MTHPJ LYRPJ )
      WRITE(6,20) IYRA,IMNTH,IANAL,MXRCS,NYRG,NYMXG,NPASS,IPCHQ,IPCHS,
     1NSTA,NCOMB,NTNOM,NCSTY,IGNHL,NPROJ,IYRPJ,MTHPJ,LYRPJ
      IF (LYRPJ-IYRA.GE.KYR) GO TO 160
CA * * * * * *  SET CONSTANTS   * * * * * * * * * * * * * * * * * * * * *
      IXX=0
      NSTAA=NSTA+1
      NSTAX=NSTA+NSTA
      T=99999999.
      IYRA=IYRA-1
```

```
      IMNTH=IMNTH-1
      NSTX=0
      NSTXX=1
      IPASS=1
      REWIND ISTAT
      NSTAT=0
      LSTAT=0
      REWIND IOTAP
      NOTAP=0
      LOTAP=0
      DO 195 J=1,KPASS
      MCOMB(J)=0
      MTNDM(J)=0
  195 CONTINUE
      GO TO 270
C                 SAVE STATIONS FROM PREVIOUS PASSES IF NECESSARY
  200 IPASS=IPASS+1
      WRITE(6,10)
      IF (IPASS.GT.KPASS) GO TO 160
C                                                          ** CARD J **
      READ(5,30)NCOMB,NTNDM,NCSTY,NSTX,(ISTA(K),K=1,NSTX)
      WRITE(6,210) IPASS,(ISTA(K),K=1,NSTX)
  210 FORMAT(5HOPASS ,I3/28H STA(S) FROM PREVIOUS PASSES ,10I6)
      NSTXX=NSTX+1
      REWIND IOTAP
      LOTAP=0
      REWIND ISTAT
      MPASS=1
      READ (ISTAT)
      LSTAT=1
      ITP=NYRS*12+1
      ITEMP=NSTNP(MPASS)
      ITMPP=0
      DO 250 K=1,NSTX
  220 READ(IOTAP)ITMP,(Q(M,K),M=1,ITP)
      LOTAP=LOTAP+1
      IF (ISTA(K).NE.ITMP) GO TO 220
  230 ITMPP=ITMPP+1
      IF(ITMPP.GT.ITEMP) GO TO 240
      READ (ISTAT)ITMP,(AV(I,K),SD(I,K),SKEW(I,K),DQ(I,K),(BETA(I,K,L),L
     1=1,ITEMP),ALCFT(I,K),I=1,12)
      LSTAT=LSTAT+1
      IF (ITMP.EQ.ISTA(K)) GO TO 250
      GO TO 230
  240 READ(ISTAT)
      LSTAT=LSTAT+1
      MPASS=MPASS+1
      ITEMP=NSTNP(MPASS)
      ITMPP=0
      GO TO 230
  250 CONTINUE
      DO 260 K=1,NSTX
      NSUM(K,IPASS)=0
      DO 260 I=1,12
  260 NLOG(I,K)=NYRS
  270 IF(IANAL.GT.0) NSTA=NSTX
      DO 280 I=1,12
      MO(I)=IMNTH+I
      IF(MO(I).LT.13)GO TO 280
      MO(I)=MO(I)-12
  280 CONTINUE
      IF(NCOMB.LE.0) GO TO 320
      MCOMB(IPASS)=NCOMB
C                IDENTIFY STATION COMBINATIONS
      DO 300 K=1,NCOMB
C                                                          ** CARD D **
      READ(5,30)ITP,(ISTAC(K,L),L=1,ITP)
      WRITE (6,290) K,ITP,(ISTAC(K,L),L=1,ITP)
  290 FORMAT (/5H COMB,I2,5H  STA,15I8)
      NSTAC(K,IPASS)=ITP
C                                                          ** CARD E **
      READ(5,60) TEMP,(CSTAC(K,L,IPASS),L=1,ITP)
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300 WRITE(6,310) (CSTAC(K,L,IPASS),L=1,ITP)
310 FORMAT (7X,5HRATIO,8X,14F8.3)
320 IF(NTNDM.LE.0) GO TO 350
    NTNDM(IPASS)=NTNDM
    DO 340 LX=1,NTNDM
C                                                        ** CARD F **
    READ(5,30) ISTN(LX),ITMP,(ISTT(LX,L),L=1,ITMP)
    WRITE(6,330) LX,ISTN(LX),(ISTT(LX,L),L=1,ITMP)
330 FORMAT (/13H TANDEM GROUP,I3,6X,14HDOWNSTREAM STA,I5,6X,
   115HUPSTREAM STA(S),10I5)
340 NSNX(LX)=ITMP
350 IF(IPASS.EQ.1)NYRS=0
    DO 380 K=NSTXX,KSTA
    NSUM(K,IPASS)=0
    ISTA(K)=1000-K
C            INITIATE -1, NO RECORD FOR ALL FLOWS
    DO 360 M=1,KM
360 Q(M,K)=-1.
    DO 370 I=1,12
    NLOG(I,K)=0
    DO(I,K)=0.
    QMIN(I,K)=T
370 CONTINUE
380 CONTINUE
    IF(NCSTY.LE.0) GO TO 420
    WRITE(6,390)
390 FORMAT(/30X,8HSTATIONS/17H CONSISTENCY TEST,5X,23HINDEPENDENT   DE
   1PENDENT)
    DO 400 L=1,NCSTY
C                                                        ** CARD G **
    READ (5,30)  ISTX(L),ISTY(L)
400 WRITE(6,410)      L,ISTX(L),ISTY(L)
410 FORMAT(13X,I3,8X,I5,8X,I5)
420 IF(IANAL.LE.0)GO TO 1570
CC * * * * * * READ AND PROCESS 1 STATION-YEAR OF DATA * * * * * * * * * *
C                                                        ** CARD H **
430 READ(5,50) ISTAN,IYR,(QM(I),I=1,12)
C                                                        ** CARD I **
C            BLANK CARD INDICATES END OF FLOW DATA
    IF(ISTAN.LT.1)GO TO 500
    IF(NSTA.LT.1)GO TO 450
C            ASSIGN SUBSCRIPT TO STATION
    DO 440 K=NSTXX,NSTA
    IF(ISTAN.EQ.ISTA(K))GO TO 460
440 CONTINUE
450 NSTA=NSTA+1
    IF(NSTA.GT.KSTA) GO TO 160
    K=NSTA
    ISTA(K)=ISTAN
C            ASSIGN SUBSCRIPT TO YEAR
460 J=IYR-IYRA
    IF(NYRS.LT.J.AND.IPASS.EQ.1)NYRS=J
    IF(J.GT.0.AND.J.LE.NYRS) GO TO 480
    WRITE (6,470)IYR
470 FORMAT (/18H UNACCEPTABLE YEAR,I5)
    GO TO 150
C            STORE FLOWS IN STATION AND MONTH ARRAY
480 M=J*12-11
    DO 490 I=1,12
    M=M+1
    IF(QM(I).LE.(-1.)) GO TO 490
    IF(QM(I).LT.QMIN(I,K)) QMIN(I,K)=QM(I)
    NLOG(I,K)=NLOG(I,K)+1
    DO(I,K)=DO(I,K)+QM(I)
    Q(M,K)=QM(I)
490 CONTINUE
    GO TO 430
500 NSTAA=NSTA+1
    IF (NYRS.GT.KYR.OR.NSTA+NCOMB.GT.KSTA) GO TO 160
    IF(NSTA.LE.0) GO TO 160
    NSTNP(IPASS)=NSTA
    NSTAX=NSTA+NSTA
```

```
      IF(NCOMB.LE.0)GO TO 540
C              IDENTIFY STA SUBSCRIPTS FOR STAS IN COMBINATIONS
      DO 530 KX=1,NCOMB
      ITP=NSTAC(KX,IPASS)
      LX=0
      DO 520 L=1,ITP
      ITEMP=ISTAC(KX,L)
      DO 510 K=1,NSTA
      IF(ISTA(K).NE.ITEMP)GO TO 510
      LX=LX+1
      KSTAC(KX,LX,IPASS)=K
      GO TO 520
  510 CONTINUE
  520 CONTINUE
C              REDUCE STATIONS TO THOSE IDENTIFIABLE
      NSTAC(KX,IPASS)=LX
  530 CONTINUE
C              IDENTIFY STATIONS IN TANDEM
  540 IF(NTNOM.LE.0) GO TO 600
      DO 590 LX=1,NTNOM
      DO 550 K=1,NSTA
      IF(ISTA(K).EQ.ISTN(LX)) GO TO 560
  550 CONTINUE
  560 ISTN(LX)=K
      NSUM(K,IPASS)=NSMX(LX)
      ITMP=NSMX(LX)
      DO 580 L=1,ITMP
      DO 570 KX=1,NSTA
      IF(ISTA(KX).EQ.ISTT(LX,L)) GO TO 580
  570 CONTINUE
  580 IST(K,L,IPASS)=KX
  590 CONTINUE
C              IDENTIFY PAIRS OF STATIONS FOR CONSISTENCY TESTS
  600 IF(NCSTY.LE.0) GO TO 650
      DO 640 L=1,NCSTY
      DO 630 K=1,NSTA
      IF(ISTA(K).EQ.ISTX(L)) GO TO 610
      IF(ISTA(K).EQ.ISTY(L)) GO TO 620
      GO TO 630
  610 ISTX(L)=K
      GO TO 630
  620 ISTY(L)=K
  630 CONTINUE
  640 CONTINUE
  650 ITMP=NSTA+NCOMB
CD * * * * * * MAX AND MIN RECORDED VOLUMES * * * * * * * * * * * * * * *
C              INITIATE SUMS
      DO 790 K=NSTXX,ITMP
      AVGQ(K)=0.
      NJ=0
      DO 660 I=1,15
  660 SMQ(I,K)=-T
      DO 670 I=16,30
  670 SMQ(I,K)=T
      TMP=0.
      TMPA=0.
      M=1
      N=0
      DO 780 J=1,NY78
      DO 770 I=1,12
      M=M+1
      N=N+1
      IF(K.LE.NSTA)GO TO 700
C              COMPUTE COMBINED FLOWS
      KY=K-NSTA
      ITP=NSTAC(KY,IPASS)
      Q(M,K)=0.
      DO 690 L=1,ITP
      ITEMP=KSTAC(KX,L,IPASS)
C              COMBINED FLOW MISSING
      IF(Q(M,ITEMP).EQ.-1..OR.Q(M,K).EQ.-1.) GO TO 680
      Q(M,K)=Q(M,K)+Q(M,ITEMP)*CSTAC(KX,L,IPASS)
```

```
      GO TO 690
  680 Q(M,K)=-1.
  690 CONTINUE
  700 IF(Q(M,K).NE.-1.) GO TO 710
C              START NEW ACCUMULATIONS WHEN FLOW MISSING
      N=0
      TMP=0.
      TMPA=0.
      GO TO 770
  710 TEMP=Q(M,K)
C              1-MONTH FLOWS
      IF(SMQ(I,K).LT.TEMP)SMQ(I,K)=TEMP
      IF(SMQ(I+15,K).GT.TEMP)SMQ(I+15,K)=TEMP
      IF(SMQ(13,K).LT.TEMP)SMQ(13,K)=TEMP
      IF(SMQ(28,K).GT.TEMP)SMQ(28,K)=TEMP
C              6-MONTH FLOWS
      TMP=TMP+TEMP
      TMPA=TMPA+TEMP
      IF(N-6)760,730,720
  720 TMP=TMP-Q(M-6,K)
  730 IF(TMP.LT.SMQ(29,K))SMQ(29,K)=TMP
      IF(TMP.GT.SMQ(14,K))SMQ(14,K)=TMP
C              54-MONTH FLOWS
      IF(N-54)760,750,740
  740 TMPA=TMPA-Q(M-54,K)
  750 IF(TMPA.LT.SMQ(30,K))SMQ(30,K)=TMPA
      IF(TMPA.GT.SMQ(15,K))SMQ(15,K)=TMPA
C              AVERAGE FLOW
  760 AVGQ(K)=AVGQ(K)+TEMP
      NQ=NQ+1
  770 CONTINUE
  780 CONTINUE
      TEMP=NQ
      AVGQ(K)=AVGQ(K)/TEMP
  790 CONTINUE
      WRITE(6,800)
  800 FORMAT(/39H MAXIMUM VOLUMES OF RECORDED FLOWS)
      WRITE(6,810)(MO(I),I=1,12)
  810 FORMAT (5H  STA,12I7,33H    1-MO     6-MO    54-MO    AV MO)
      ITMP=NSTA+NCOMB
      DO 830 K=NSTXX,ITMP
      ITEMP=AVGQ(K)+.5
      DO 820 I=1,15
  820 IQ(I)=SMQ(I,K)+.5
  830 WRITE(6,840)ISTA(K),(IQ(I),I=1,15),ITEMP
  840 FORMAT(1X,I4,12I7,2I8,I9,I8)
      WRITE(6,850)
  850 FORMAT(/16H MINIMUM VOLUMES)
      WRITE(6,810)(MO(I),I=1,12)
      DO 870 K=NSTXX,ITMP
      DO 860 I=1,15
  860 IQ(I)=SMQ(I+15,K)+.5
  870 WRITE(6,840)ISTA(K),(IQ(I),I=1,15)
CE * * * * * * COMPUTE FREQUENCY STATISTICS * * * * * * * * * * * * * * *
      WRITE (6,880)
  880 FORMAT (/21H FREQUENCY STATISTICS)
      WRITE(6,890)(MO(I),I=1,12)
  890 FORMAT (/14H   STA     ITEM,I7,11I8)
C              MISSING FLOW PRECEDING FIRST RECORD MONTH
      DO 900 K=NSTXX,NSTA
  900 Q(1,K)=T
      IPCON=0
      ITEMP = NSTA
      DO 1180 K=1,ITEMP
      IF (ITEMP.GT.NSTA) GO TO 1180
      IF(K.LE.NSTX) GO TO 942
  910 DO 920 I=1,12
      TEMP=NLOG(I,K)
      DQ(I,K)=DQ(I,K)*.01/TEMP
      IF(DQ(I,K).LT..1) DQ(I,K)=.1
      IF(QMIN(I,K).LT.0.) DQ(I,K)=DQ(I,K)-QMIN(I,K)
  920 CONTINUE
```

```
      N=0
  930 DO 940 I=1,12
      AV(I,K)=0.
      SD(I,K)=0.
      SKEW(I,K)=0.
      THP=N
      XINCR(I)=(DQ(I,K)+QMIN(I,K))/(16.-THP)
  940 CONTINUE
  942 M=1
      DO 970 J=1,NYRS
      DO 960 I=1,12
      M=M+1
      IF(Q(M,K).EQ.-1.) GO TO 950
C               REPLACE FLOW ARRAY WITH LOG ARRAY
      TEMP=ALOG(Q(M,K)+DQ(I,K))/2.3025851
      Q(M,K)=TEMP
      IF(K.LE.NSTX) GO TO 960
C               SUM, SQUARES, AND CUBES
      AV(I,K)=AV(I,K)+TEMP
      SD(I,K)=SD(I,K)+TEMP*TEMP
      SKEW(I,K)=SKEW(I,K)+TEMP*TEMP*TEMP
      GO TO 960
C               MISSING FLOWS EQUATED TO T
  950 Q(M,K)=T
      ISCON=1
  960 CONTINUE
  970 CONTINUE
      IF(K.LE.NSTX) GO TO 1180
      INDC=0
      DO 1000 I=1,12
      TEMP=NLOG(I,K)
      IF(TEMP.LT.3.)GO TO 1120
      THP=AV(I,K)
      AV(I,K)=THP/TEMP
      IF(SD(I,K).LE.0.)GO TO 980
      THPA=SD(I,K)
      SD(I,K)=(SD(I,K)-AV(I,K)*THP)/(TEMP-1.)
      IF(SD(I,K).LE.0.) GO TO 980
      SD(I,K)=SD(I,K)**.5
      IF(SD(I,K).LT..0005) GO TO 990
      SKEW(I,K)=(TEMP*TEMP*SKEW(I,K)-3.*TEMP*THP*THPA+2.*THP*THP*THP)
     1/(TEMP*(TEMP-1.)*(TEMP-2.)*SD(I,K)**3)
      IF(SKEW(I,K).LT.(-.1).OR.SKEW(I,K).GT..1) INDC=1
      IF(SKEW(I,K).GT.3.) SKEW(I,K)=3.
      IF(SKEW(I,K).LT.-3.) SKEW(I,K)=-3.
      GO TO 1000
  980 SD(I,K)=0.
  990 SKEW(I,K)=0.
 1000 CONTINUE
      N=N+1
      IF(N.GT.1)GO TO 1060
      WRITE(6,1010)ISTA(K),(AV(I,K),I=1,12)
 1010 FORMAT (/1X,I5,8H    MEAN,12F8.3)
      WRITE(6,1020)(SD(I,K),I=1,12)
 1020 FORMAT (7X,7HSTD DEV,12F8.3)
      WRITE(6,1030)(SKEW(I,K),I=1,12)
 1030 FORMAT (10X,4HSKEW,12F8.3)
      WRITE(6,1040)(DQ(I,K),I=1,12)
 1040 FORMAT (8X,6HINCRMT,F7.2,11F8.2)
      WRITE(6,1050)(NLOG(I,K),I=1,12)
 1050 FORMAT (9X,5HYEARS,12I8)
 1060 IF(N.GE.14) GO TO 1180
      IF(INDC.LE.0) GO TO 1180
C               THE FOLLOWING ROUTINE WILL ADJUST THE INCREMENT TO
C                TRY TO OBTAIN ZERO SKEW
C                 CHANGE THE FOLLOWING STAT TO  ISKZ=1  TO ACTIVATE
      ISKZ=0
      IF(ISKZ.LE.0) GO TO 1180
      ITP=-11
      DO 1110 I=1,12
      M=ITP+I
      DO 1080 J=1,NYRS
```

```
      M=M+12
      IF(Q(M,K).EQ.T) GO TO 1070
      TMP=Q(M,K)
      Q(M,K)=10.**TMP -DQ(I,K)
      GO TO 1080
 1070 Q(M,K)=-1.
 1080 CONTINUE
      TEMP=SKEW(I,K)
      IF(TEMP.GT.(-.1).AND.TEMP.LT..1) GO TO 1110
      IF(TEMP) 1090,1110,1100
 1090 DQ(I,K)=DQ(I,K)*2.
      GO TO 1110
 1100 DQ(I,K)=DQ(I,K)*XINCH(I)
 1110 CONTINUE
      GO TO 930
C  * * * * * * DELETE STATIONS WITH LESS THAN 3 YEARS OF DATA* * * * * *
 1120 WRITE(6,1130)ISTA(K)
 1130 FORMAT (/4H STA,I6,28H  DELETED, INSUFFICIENT DATA)
      NSTA=NSTA-1
      NSTAA=NSTA+1
      NSTAX=NSTA+NSTA
      IF(K.GT.NSTA)GO TO 1180
C                 REDUCE SUBSCRIPTS OF SUBSEQUENT STATIONS
      DO 1170 KX=K,NSTA
      ISTA(KX)=ISTA(KX+1)
      M=1
      DO 1150 J=1,NYRS
      DO 1140 I=1,12
      M=M+1
 1140 Q(M,KX)=Q(M,KX+1)
 1150 CONTINUE
      DO 1160 I=1,12
      QMIN(I,KX)=QMIN(I,KX+1)
      NLOG(I,KX)=NLOG(I,KX+1)
 1160 DQ(I,KX)=DQ(I,KX+1)
 1170 CONTINUE
      GO TO 910
 1180 CONTINUE
      ITRNS=0
      IF(TRCON.LE.0) GO TO 1370
CF* * * * * *  ADJUSTMENT OF FREQUENCY STATISTICS TO LONG TERM    * * * *
      DO 1190 I=1,12
      DO 1190 K=1,NSTA
      DO 1190 L=1,NSTAX
      NCAB(I,K,L)=0
      SUMA(I,K,L)=0.
      SUMB(I,K,L)=0.
      SQA(I,K,L)=0.
      SQB(I,K,L)=0.
      XPAB(I,K,L)=0.
      RA(I,K,L)=-4.
 1190 CONTINUE
      DO 1220  K=1,NSTA
      KX=K+1
      M=1
      DO 1220 J=1,NYRS
      DO 1210 I=1,12
      M=M+1
      TEMP=Q(M,K)
      IF(TEMP.EQ.T) GO TO 1210
      DO 1200 L=KX,NSTAX
      LX=L-NSTA
      IF(LX.LT.1) TMP=Q(M,L)
      IF(LX.GT.0) TMP=Q(M-1,LX)
      IF(TMP.EQ.T) GO TO 1200
      NCAB(I,K,L)=NCAB(I,K,L)+1
      SUMA(I,K,L)=SUMA(I,K,L)+TEMP
      SUMB(I,K,L)=SUMB(I,K,L)+TMP
      SQA(I,K,L)=SQA(I,K,L)+TEMP*TEMP
      SQB(I,K,L)=SQB(I,K,L)+TMP*TMP
      XPAB(I,K,L)=XPAB(I,K,L)+TEMP*TMP
      IF(L.GT.NSTA) GO TO 1200
```

```
      NCAB(I,L,K)=NCAB(I,K,L)
      SUMA(I,L,K)=SUMB(I,K,L)
      SUMB(I,L,K)=SUMA(I,K,L)
      SQA(I,L,K)=SQB(I,K,L)
      SQB(I,L,K)=SQA(I,K,L)
      XPAB(I,L,K)=XPAB(I,K,L)
 1200 CONTINUE
 1210 CONTINUE
 1220 CONTINUE
      INDC=0
      DO 1260 K=1,NSTA
      KX=K+1
      DO 1260 I=1,12
      RA(I,K,K)=1.
      DO 1250 L=KX,NSTAX
      IF(NCAB(I,K,L).LE.2) GO TO 1250
      TEMP=NCAB(I,K,L)
      TMP=SQA(I,K,L)
      TP=SQB(I,K,L)
      TMPA=SUMA(I,K,L)
      TMPP=(TMP-TMPA**2/TEMP)/TEMP
      IF(TMPP.LT.0.) TMPP=0.
      SQA(I,K,L)=TMPP**.5
      TMPB=SUMB(I,K,L)
      TMPP=(TP-TMPB**2/TEMP)/TEMP
      IF(TMPP.LT.0.) TMPP=0.
      SQB(I,K,L)=TMPP**.5
      TMP=(TMP-TMPA**2/TEMP)*(TP-TMPB**2/TEMP)
      IF(TMP.LE.0.) GO TO 1230
      TMPA=XPAB(I,K,L)-TMPA*TMPB/TEMP
      TMPB=1.
      IF(TMPA.LT.0.) TMPB=-TMPB
      TMPA=TMPA*TMPA/TMP
      TMPA=1.-(1.-TMPA)*(TEMP-1.)/(TEMP-2.)
      IF(TMPA.LT.0.)TMPA=0.
      RA(I,K,L)=TMPB*TMPA**.5
      ITP=I
      LA=L
      LX=L-NSTA
      IF(L.LE.NSTA) GO TO 1235
      ITP=I-1
      IF(ITP.LT.1) ITP=12
      LA=LX
 1235 IF(SD(I,K).LT..0001.OR.SD(ITP,LA).LT..0001) GO TO 1230
      GO TO 1240
 1230 RA(I,K,L)=0.
 1240 IF(L.GT.NSTA) GO TO 1250
      SQA(I,L,K)=SQB(I,K,L)
      SQB(I,L,K)=SQA(I,K,L)
      RA(I,L,K)=RA(I,K,L)
 1250 CONTINUE
 1260 CONTINUE
      DO 1280 K=1,NSTA
      DO 1280 I=1,12
      TEMP=NLOG(I,K)
      LX=0
      DO 1270 L=1,NSTA
      IF(L.EQ.K.OR.RA(I,K,L).LE.-4.) GO TO 1270
      IF(NLOG(I,L).LE.NLOG(I,K)) GO TO 1270
      TMPA=NCAB(I,K,L)
      TMPB=NLOG(I,L)
      TP=TMPA/(1.-(TMPB-TMPA)*RA(I,K,L)**2/TMPB)
      IF(TP.LE.TEMP) GO TO 1270
      LX=L
      TEMP=TP
      THPP=THPA
 1270 CONTINUR
      IF(LX.LE.0) GO TO 1280
      IF(SQA(I,K,LX).LE..0001.OR.SQB(I,K,LX).LE..0001) GO TO 1280
      INDC=1
      TMP=SQA(I,K,LX)/SQB(I,K,LX)
      TMPA=SUMA(I,K,LX)/THPP
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      TMPB=SUMB(I,K,LX)/TMPP
      AV(I,K)=TMPA+(AV(I,LX)-TMPB)*RA(I,K,LX)*TMP
      SD(I,K)=SDA(I,K,LX)+(SD(I,LX)-SDB(I,K,LX))*RA(I,K,LX)**2*TMP
 1280 CONTINUE
C                 ADJUST STANDARD DEVIATIONS FOR CONSISTENCY
      IF(NCSTY.LE.0) GO TO 1340
C                 TRANSFER FROM 1011
 1290 DO 1330 LX=1,NCSTY
      K=ISTX(LX)
      L=ISTY(LX)
      DO 1320 I=1,12
      TEMP=(AV(I,K)-AV(I,L))/3.
      IF(AV(I,K).GT.AV(I,L)) GO TO 1300
      TEMP=TEMP+SD(I,K)
      IF(SD(I,L).LT.TEMP) GO TO 1310
      TEMP=SD(I,K)*2.-TEMP
      IF(SD(I,L) - TEMP) 1320,1320,1310
 1300 TEMP=TEMP+SD(I,K)
      IF(SD(I,L).GT.TEMP) GO TO 1310
      TEMP=SD(I,K)*2. - TEMP
      IF(SD(I,L).GE.TEMP) GO TO 1320
 1310 SD(I,L)=TEMP
 1320 CONTINUE
 1330 CONTINUE
      IF(ITRNS.GT.0) GO TO 2820
 1340 IF(INOC.LE.0.AND.NCSTY.LE.0) GO TO 1370
      WRITE(6,1350)
 1350 FORMAT(/39H FREQUENCY STATISTICS AFTER ADJUSTMENTS )
      WRITE(6,890)(MO(I),I=1,12)
      DO 1360 K=1,NSTA
      WRITE(6,1010)ISTA(K),(AV(I,K),I=1,12)
      WRITE(5,1020)(SD(I,K),I=1,12)
      WRITE(6,1030)(SKEW(I,K),I=1,12)
      WRITE(6,1040)(DO(I,K),I=1,12)
 1360 CONTINUE
CG * * * * * * TRANSFORM TO STANDARDIZED VARIATES  * * * * * * * * * * * * *
 1370 DO 1420 K=1,NSTA
      M=1
      DO 1410 J=1,NYRS
      DO 1400 I=1,12
      M=M+1
      OR(M,K)=BLANK
      IF(Q(M,K).EQ.T)GO TO 1400
      IF(SD(I,K).EQ.0.)GO TO 1390
      Q(M,K)=(Q(M,K)-AV(I,K))/SD(I,K)
C                 PEARSON TYPE III TRANSFORM
      IF(SKEW(I,K).EQ.0.)GO TO 1400
      TEMP=.5*SKEW(I,K)*Q(M,K)+1.
      TMP=1.
      IF(TEMP.GE.0.)GO TO 1380
      TEMP=-TEMP
      TMP=-1.
 1380 Q(M,K)=6.*(TMP*TEMP**(1./3.)-1.)/SKEW(I,K)+SKEW(I,K)/6.
      GO TO 1400
 1390 Q(M,K)=0.
 1400 CONTINUE
 1410 CONTINUE
 1420 CONTINUE
C  * * * * * * COMPUTE SUMS OF SQUARES AND CROSS PRODUCTS  * * * * * * *
      DO 1450 K=1,NSTA
      DO 1440 I=1,12
      DO 1430 L=1,NSTAX
      RA(I,K,L) =(-4.)
      SUMA(I,K,L)=0.
      SUMB(I,K,L)=0.
      SDA(I,K,L)=0.
      SDB(I,K,L)=0.
      XPAR(I,K,L)=0.
 1430 NCAR(I,K,L)=0
      RA(I,K,K)=1.
 1440 CONTINUE
 1450 CONTINUE
```

```
      DO 1540 K=1,NSTA
      KX=K+1
      M=1
      DO 1480 J=1,NYRS
      DO 1470 I=1,12
      M=M+1
      TEMP=Q(M,K)
      IF(TEMP.EQ.T)GO TO 1470
      DO 1460 L=KX,NSTAX
C               SUBSCRIPTS EXCEEDING NSTA RELATE TO PRECEDING MONTH
      LX=L-NSTA
      IF(LX.LT.1) TMP=Q(M,L)
      IF(LX.GT.0) TMP=Q(M-1,LX)
      IF(TMP.EQ.T)GO TO 1460
C               COUNT AND USE ONLY RECORDED PAIRS
      NCAB(I,K,L)=NCAB(I,K,L)+1
      SUMA(I,K,L)=SUMA(I,K,L)+TEMP
      SUMB(I,K,L)=SUMB(I,K,L)+TMP
      SQA (I,K,L)=SQA (I,K,L)+TEMP*TEMP
      SQB (I,K,L)=SQB (I,K,L)+TMP*TMP
      XPAB(I,K,L)=XPAB(I,K,L)+TEMP*TMP
      IF(L.GT.NSTA) GO TO 1460
      NCAB(I,L,K)=NCAB(I,K,L)
      SUMA(I,L,K)=SUMB(I,K,L)
      SUMB(I,L,K)=SUMA(I,K,L)
      SQA (I,L,K)=SQB (I,K,L)
      SQB (I,L,K)=SQA (I,K,L)
      XPAB(I,L,K)=XPAB(I,K,L)
 1460 CONTINUE
 1470 CONTINUE
 1480 CONTINUE
C  * * * * * * COMPUTE CORRELATION COEFFICIENTS  * * * * * * * * * * * * * *
      DO 1530 I=1,12
      DO 1520 L=KX,NSTAX
      LX=L-NSTA
C               ELIMINATE PAIRS WITH LESS THAN 3 YRS DATA
      IF(NCAB(I,K,L).LE.2) GO TO 1510
      TEMP=NCAB(I,K,L)
      TMP=(SQA(I,K,L)-SUMA(I,K,L)*SUMA(I,K,L)/TEMP)*(SQB(I,K,L)-SUMB
     1(I,K,L)*SUMB(I,K,L)/TEMP)
C               ELIMINATE PAIRS WITH ZERO VARIANCE PRODUCT
      IF(TMP.LE.0.) GO TO 1500
      TMPB=1.
      TMPA=XPAB(I,K,L)-SUMA(I,K,L)*SUMB(I,K,L)/TEMP
C               RETAIN ALGEBRAIC SIGN
      IF(TMPA.LT.0.)TMPB=-TMPB
      TMPA=TMPA*TMPA/TMP
      RA(I,K,L)=TMPB*TMPA**.5
      ITP=I
      LA=L
      IF(L.LE.NSTA) GO TO 1490
      ITP=I-1
      IF(ITP.LT.1) ITP=12
      LA=LX
 1490 IF(SD(I,K).LT..0001.OR.SD(ITP,LA).LT..0001) RA(I,K,L)=0.
      GO TO 1510
 1500 RA(I,K,L)=0.
 1510 IF(L.GT.NSTA) GO TO 1520
      RA(I,L,K)=RA(I,K,L)
 1520 CONTINUE
 1530 CONTINUE
 1540 CONTINUE
      GO TO 2170
 1550 WRITE(6,1560)
 1560 FORMAT(/18H DATA OUT OF ORDER)
      GO TO 150
C* * * * * * * READ CORRELATION COEFFICIENTS * * * * * * * * * * * * * * * *
 1570 DO 1630 K=1,NSTA
      IF (K.EQ.1)GO TO 1600
      ITP=K-1
      DO 1590 L=1,ITP
C              CURRENT MONTH CORRELATION
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C                                                          ** CARD L **
      READ(5,70)ITMP,ITEMP,(RA(I,K,L),I=1,12)
      RAV(K,L)=RA(1,K,L)
      IF(IGNRL.EQ.1)ISTA(K)=ITMP
      IF(ITMP.NE.ISTA(K))GO TO 1550
      IF(ITEMP.NE.ISTA(L))GO TO 1550
      DO 1580 I=1,12
 1580 RA(I,L,K)=RA(I,K,L)
 1590 CONTINUE
C              PRECEDING MONTH CORRELATION
 1600 LX=NSTAA
      IF (IGNRL.EQ.1) LX=NSTA+K
      LA=NSTAX
      IF (IGNRL.EQ.1) LA=LX
      DO 1610 L=LX,LA
      ITP=L-NSTA
C                                                     ** CARD K OR M **
      READ(5,70)ITMP,ITEMP,(RA(I,K,L),I=1,12)
      IF(K.EQ.1)ISTA(K)=ITMP
      IF(K.EQ.1)ISTA(ITP)=ITEMP
      IF (IGNRL.EQ.1) RAV(K,K)=RA(1,K,L)
      IF(ITMP.NE.ISTA(K))GO TO 1550
      IF(ITEMP.NE.ISTA(ITP))GO TO 1550
 1610 CONTINUE
      DO 1620 I=1,12
 1620 RA(I,K,K)=1.
 1630 CONTINUE
C  * * * * * * READ FREQUENCY STATISTICS * * * * * * * * * * * * * * * * *
      DO 1640 K=1,NSTA
C                                                     ** CARD N OR O **
      READ(5,80) ITP,(AV(I,K),I=1,12)
      IF(ITP.NE.ISTA(K))GO TO 1550
C              GENERALIZED STATISTICS ON ONE CARD PER STATION
      AVMX(K)=AV(1,K)
      AVMN(K)=AV(2,K)
      SDAV(K)=AV(3,K)
      ITMP=AV(4,K)+.1
      IMX(K)=ITMP-M0(12)
      ITMP=AV(5,K)+.1
      IMN(K)=ITMP-M0(12)
      IF (IMX(K).LT.1) IMX(K)=IMX(K)+12
      IF (IMN(K).LT.1) IMN(K)=IMN(K)+12
      IF(IGNRL.EQ.1)GO TO 1640
C                                                          ** CARD P **
      READ(5,80)ITP,(SD(I,K),I=1,12)
      IF(ITP.NE.ISTA(K))GO TO 1550
C                                                          ** CARD Q **
      READ(5,80)ITP,(SKEW(I,K),I=1,12)
      IF(ITP.NE.ISTA(K))GO TO 1550
C                                                          ** CARD R **
      READ(5,90)ITP,(DD(I,K),I=1,12)
      IF(ITP.NE.ISTA(K))GO TO 1550
 1640 CONTINUE
C * * * * * * ESTIMATE MISSING CORRELATION COEFFICIENTS * * * * * * * * *
 1650 IF(IGNRL.EQ.1)GO TO 3020
      IF(NSTA.LE.1)GO TO 2310
      DO 1720 I=1,12
      IP=I-1
      IF(IP.LT.1)IP=12
      DO 1710 K=1,NSTA
      ITP=K+1
      DO 1700 L=ITP,NSTAX
C              L AND K CORRELATION POSSIBLY MISSING
      IF(RA(I,K,L).GE.(-1.)) GO TO 1700
      RMAX=1.
      RMIN=-1.
C              LX SEARCHES ALL RELATED CORRELATIONS EXCEPT FOLLOWING MTH
      DO 1690 LX=1,NSTAX
      IF(LX.EQ.K)GO TO 1690
      IF(L.EQ.LX)GO TO 1690
      TEMP=RA(I,K,LX)
      IF(L.LE.NSTA)GO TO 1660
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```
      IF(LX.LE.NSTA)GO TO 1670
C               BOTH L AND LX REPRESENT PRECEDING MONTH
      ITMP=L-NSTA
      ITEMP=LX-NSTA
      TMP=RA(IP,ITMP,ITEMP)
      GO TO 1680
C               L REPRESENTS CURRENT MONTH
 1660 TMP=RA(I,L,LX)
      GO TO 1680
C               LX AND NOT L REPRESENTS CURRENT MONTH
 1670 TMP=RA(I,LX,L)
 1680 IF (TMP+TEMP.LT.-2.0) GO TO 1690
      TMPA=((1.-TEMP*TEMP)*(1.-TMP*TMP))
      IF(TMPA.LT.0.)TMPA=0.
      TMPA=TMPA**.5
      TMPB=TMP*TEMP+TMPA
      IF(TMPB.LT.RMAX)RMAX=TMPB
      TMPB=TMPB-TMPA-TMPA
      IF(TMPB.GT.RMIN)RMIN=TMPB
 1690 CONTINUE
C               AVERAGE SHALLEST MAX AND LARGEST MIN CONSISTENT VALUE
      RA(I,K,L)=(RMAX+RMIN)*.5
      IF(L.LE.NSTA)RA(I,L,K)=RA(I,K,L)
 1700 CONTINUE
 1710 CONTINUE
 1720 CONTINUE
      GO TO 2310
CJ * * * * * * TEST FOR TRIAD CONSISTENCY * * * * * * * * * * * * * * * *
 1730 NCB=0
 1740 FAC=1.
      NCA=NCA+1
      IF(NCA.LT.NSTA*12) GO TO 1750
      WRITE(6,1840)
      GO TO 150
 1750 NCB=0
      NC=0
 1760 INCC=0
      DO 1830 I=1,12
      IP=I-1
      IF(IP.LT.1)IP=12
C               K, L, AND LX SEARCH ALL RELATED TRIOS OF CORREL COEFS
      DO 1820 K=1,NSTA
      ITMP=K+1
      DO 1810 L=ITMP,NSTAX
      IF(L.EQ.NSTAX)GO TO 1810
      LA=L-NSTA
      R1=RA(I,K,L)
      ITP=L+1
      DO 1800 LX=ITP,NSTAX
      ITEMP=LX-NSTA
      R2=RA(I,K,LX)
      IF(L.LE.NSTA)R3=RA(I,L,LX)
C               BOTH L AND LX REPRESENT PRECEDING MONTH
      IF(L.GT.NSTA)R3=RA(IP,LA,ITEMP)
C               RAISE LOWEST COEFFICIENT IF INCONSISTENT
      AC1=(1.-R1*R1)**.5
      AC2=(1.-R2*R2)**.5
      AC3=(1.-R3*R3)**.5
      IF(R1.GT.R2) GO TO 1770
      IF(R1.GT.R3) GO TO 1780
      RMIN=R2*R3-AC2*AC3*FAC
      IF(RMIN.LT.-1.) RMIN=-1.
      IF(R1.GE.RMIN) GO TO 1800
      INDC=1
      RA(I,K,L)=RMIN
      IF (L.LE.NSTA) RA(I,L,K)=RMIN
      GO TO 1800
 1770 IF(R2.GT.R3) GO TO 1780
      RMIN=R1*R3-AC1*AC3*FAC
      IF(RMIN.LT.-1.) RMIN=-1.
      IF(R2.GE.RMIN) GO TO 1800
      INDC=1
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      RA(I,K,LX)=RMIN
      IF (LX.LE.NSTA) RA(I,LX,K)=RMIN
      GO TO 1800
 1780 RMIN=R1*R2-AC1*AC2*FAC
      IF(RMIN.LT.-1.) RMIN=-1.
      IF(R3.GE.RMIN) GO TO 1800
      INDC=1
      IF (L.GT.NSTA) GO TO 1790
      RA(I,L,LX)=RMIN
      IF (LX.LE.NSTA) RA(I,LX,L)=RMIN
      GO TO 1800
 1790 RA(IP,LA,ITEMP)=RMIN
      RA(IP,ITEMP,LA)=RMIN
 1800 CONTINUE
 1810 CONTINUE
 1820 CONTINUE
 1830 CONTINUE
      NC=NC+1
      IF(NC.LE.NSTA*12) GO TO 1850
      WRITE(6,1840)
 1840 FORMAT(32H CORRELATION MATRIX INCONSISTENT)
      GO TO 150
 1850 IF(INDC.EQ.1) GO TO 1760
CK * * * * * * TEST FOR OVER-ALL CONSISTENCY * * * * * * * * * * * * * *
      ITEMP=0
      GO TO 1870
 1860 ITEMP=1
C               WHEN ITEMP=1, CURRENT MONTH USED FOR ALL INDEPENDENT STAS
C               OTHERWISE, PREC MTH USED FOR CURRENT AND SUBSEQUENT STAS
 1870 NINDP=NSTA
      NVAR=NINDP+1
      DO 2150 I=1,12
      IP=I-1
      IF(IP.LT.1)IP=12
C               CONSTRUCT COMPLETE CORREL MATRIX FOR EACH MONTH AND STA
      DO 2150 K=1,NSTA
C               L IS ROW NUMBER, J IS COLUMN NUMBER
      DO 2020 L=1,NSTA
      LX=L+NSTA
      DO 1980 J=1,NSTA
      JX=J+NSTA
      IF(L-K) 1880,1920,1960
 1880 IF(J-K) 1890,1910,1900
 1890 R(L,J) = DBLE(RA(I,L,J))
      LTMP(L)=L
      JTMP(J)=J
      GO TO 1970
 1900 IF(ITEMP) 1910,1910,1890
 1910 R(L,J) = DBLE(RA(I,L,JX))
      LTMP(L)=L
      JTMP(J)=JX
      GO TO 1970
 1920 IF(J-K) 1930,1940,1950
 1930 R(L,J) = DBLE(RA(I,J,LX))
      LTMP(L)=J
      JTMP(J)=LX
      GO TO 1970
 1940 R(L,J) = DBLE(RA(IP,L,J))
      LTMP(L)=LX
      JTMP(J)=JX
      GO TO 1970
 1950 IF(ITEMP) 1940,1940,1930
 1960 IF(ITEMP) 1920,1920,1880
 1970 R(J,L)=R(L,J)
 1980 CONTINUE
      LTMP(L)=K
C               SPECIAL SUBSCRIPT FOR DEPENDENT VARIABLE
      IF (L-K) 1990,2010,2000
 1990 R(L,NSTAA) = DBLE(RA(I,K,L))
      JTMP(NSTAA)=L
      GO TO 2020
 2000 IF (ITEMP.GT.0) GO TO 1990
```

```
 2010 R(L,NSTAA) = DBLE(RA(I,K,LX))
      JTMP(NSTAA)=LX
 2020 CONTINUE
C              MATRIX CONSISTENT IF CORREL DOES NOT EXCEED 1.0
      N=0
      NC=0
C     ==========
 2030 CALL CROUT(R)
C     ==========
      IF(DTRMC.LE.1.) GO TO 2130
      WRITE(6,2040) N,I,K,DTRMC
 2040 FORMAT (/36H INCONSISTENT CORREL MATRIX ADJUSTED,3I4,F12.3)
C                                                          WITHDRAW 1928-1931
      FAC=FAC-.2
      IF(FAC.GT.-.1)GO TO 1750
      NC0=1
      N=N+1
      IF(N.GT.10) GO TO 150
      SUM=0.
      DO 2080 L=1,NINDP
      DO 2070 LX=1,NVAR
      IF(L.EQ.LX) GO TO 2070
      TMPP=R(L,LX)
      SUM=SUM+TMPP
 2070 CONTINUE
 2080 CONTINUE
      TEMP=NINDP*NINDP
      SUM=SUM/TEMP
      TEMP=DTRMC-1.
      IF(TEMP.GT..1) TEMP=.1
      TMP=1.-TEMP
      DO 2120 L=1,NINDP
      ITP=L+1
      DO 2110 LX=ITP,NVAR
      R(L,LX) = DBLE(TMPP*TMP + SUM*TEMP)
      IF(LX.LE.NINDP) R(LX,L)=R(L,LX)
      LTP=LTMP(L)
      JTP=JTMP(LX)
      IF(LTP.LE.NSTA) GO TO 2100
      IF(JTP.LE.NSTA) GO TO 2090
      LTP=LTP-NSTA
      JTP=JTP-NSTA
      RA(IP,LTP,JTP)=R(L,LX)
      RA(IP,JTP,LTP)=R(L,LX)
      GO TO 2110
 2090 ITMP=LTP
      LTP=JTP
      JTP=ITMP
 2100 RA(I,LTP,JTP)=R(L,LX)
      IF(JTP.LE.NSTA) RA(I,JTP,LTP)=R(L,LX)
 2110 CONTINUE
 2120 CONTINUE
      GO TO 2030
 2130 IF(DTRMC.GE.0.) GO TO 2140
      WRITE(6,70)I,K,DTRMC
      DTRMC=0.
 2140 IF(NC0.GT.0) GO TO 1740
 2150 CONTINUE
 2160 CONTINUE
      IF (ITEMP.EQ.0) GO TO 1860
      IF(ITRNS.EQ.2) GO TO 3100
 2170 WRITE(6,10)
C  * * * * * * PRINT CORRELATION MATRIX  * * * * * * * * * * * * * * * * * *
      DO 2260 I=1,12
      IF(ITRNS.LE.0) WRITE(6,2180)MO(I)
 2180 FORMAT (//39H RAW CORRELATION COEFFICIENTS FOR MONTH,I3)
      IF(ITRNS.GT.0) WRITE(6,2190) MO(I)
 2190 FORMAT (//40H CONSISTENT CORRELATION MATRIX FOR MONTH,I3)
      WRITE(6,2200)(ISTA(K),K=1,NSTA)
 2200 FORMAT (/3X,3HSTA,18I7)
      WRITE(6,2210)
 2210 FORMAT(20X,19H WITH CURRENT MONTH)
```

```
      DO 2220 K=1,NSTA
 2220 WRITE(6,2230) ISTA(K),(RA(I,K,L),L=1,NSTA)
 2230 FORMAT (1X,I5,18F7.3)
      WRITE(6,2240)
 2240 FORMAT (20X,36H WITH PRECEDING MONTH AT ABOVE STATION)
      ITP=NSTA+1
      DO 2250 K=1,NSTA
 2250 WRITE(6,2230)ISTA(K),(RA(I,K,L),L=ITP,NSTAX)
 2260 CONTINUE
      IF(IANAL.LE.0) GO TO 3100
      IF(ITRNS.LE.0) GO TO 1650
      IF(IPCHS.LE.0) GO TO 2870
C               PUNCH ESSENTIAL ELEMENTS OF MATRIX
      DO 2300 K=1,NSTA
      IF (K.EQ.1) GO TO 2280
      ITP=K-1
      DO 2270 L=1,ITP
 2270 WRITE(7,70)ISTA(K),ISTA(L),(RA(I,K,L),I=1,12)
 2280 DO 2290 L=NSTAA,NSTAX
      ITEMP=L-NSTA
 2290 WRITE(7,70) ISTA(K),ISTA(ITEMP),(RA(I,K,L),I=1,12)
 2300 CONTINUE
      GO TO 2850
CL * * * * * * RECONSTITUTE MISSING DATA * * * * * * * * * * * * * * * * *
 2310 IF(IANAL.LE.0) GO TO 3100
      IF (IRCON.LE.0) GO TO 2610
      NVAR=NSTA+1
      M=1
      DO 2600 J=1,NYRS
      DO 2590 I=1,12
      IX=I-1
      IF(IX.LT.1)IX=12
      M=M+1
      DO 2580 K=1,NSTA
      IF(Q(M,K).NE.T) GO TO 2580
C               FORM CORRELATION MATRIX FOR EACH MISSING FLOW
      NINDP=0
      DO 2390 L=1,NSTA
      LX=L+NSTA
      IF(Q(M,L).NE.T) GO TO 2320
      IF(Q(M-1,L).EQ.T) GO TO 2390
      NINDP=NINDP+1
      ITEMP=NINDP
      X(NINDP)=Q(M-1,L)
      R(NINDP,NVAR) = DBLE(RA(I,K,LX))
      GO TO 2330
 2320 NINDP=NINDP+1
      ITEMP=NINDP
      X(NINDP)=Q(M,L)
      R(NINDP,NVAR) = DBLE(RA(I,K,L))
 2330 R(NINDP,NINDP) = 1.0D0
      IF(L.EQ.NSTA) GO TO 2390
      ITP=L+1
      DO 2380 LA=ITP,NSTA
      JX=LA+NSTA
      IF(Q(M,L).EQ.T) GO TO 2350
      IF(Q(M,LA).EQ.T) GO TO 2340
      ITEMP=ITEMP+1
      R(NINDP,ITEMP) = DBLE(RA(I,L,LA))
      GO TO 2370
 2340 IF(Q(M-1,LA).EQ.T) GO TO 2380
      ITEMP=ITEMP+1
      R(NINDP,ITEMP) = DBLE(RA(I,L,JX))
      GO TO 2370
 2350 IF(Q(M,LA).EQ.T) GO TO 2360
      ITEMP=ITEMP+1
      R(NINDP,ITEMP) = DBLE(RA(I,LA,LX))
      GO TO 2370
 2360 IF(Q(M-1,LA).EQ.T) GO TO 2380
      ITEMP=ITEMP+1
      R(NINDP,ITEMP) = DBLE(RA(IX,L,LA))
C               ADD SYMMETRICAL ELEMENTS
```

```
 2370 R(ITEMP,NINDP)=R(NINDP,ITEMP)
 2380 CONTINUE
 2390 CONTINUE
      IF(NINDP.GT.0) GO TO 2400
      NINDP=1
      X(1)=0.
      R(1,1) = 1.000
      LX=K+NSTA
      R(1,NVAR) = DBLE(RA(I,K,LX))
 2400 ITEMP=NINDP+1
      DO 2410 L=1,NINDP
 2410 R(L,ITEMP)=R(L,NVAR)
C     ==========
 2420 CALL CROUT (R)
C     ==========
      ITEMP=NINDP+1
      TEMP=1.
      INDC=0
      DO 2440 L=1,NINDP
      THP=DABS(R(L,ITEMP))
      IF(THP.GT.TEMP) GO TO 2430
      TEMP=THP
      ITP=L
 2430 IF(R(L,ITEMP).LE.0..AND.B(L).GT.(-1.5).AND.B(L).LT.0.5) GO TO 2440
      IF(R(L,ITEMP).GE.0..AND.B(L).GT.(-0.5).AND.B(L).LT.1.5) GO TO 2440
      INDC=1
 2440 CONTINUE
      IF(INDC.GT.0) GO TO 2450
      IF(DTRMC.LE.1..AND.DTRMC.GE.0.) GO TO 2510
C               IF MATRIX INCONSISTENT, OMIT VARIABLE WITH LEAST
C                      CORRELATION
 2450 ITMP=NINDP-1
      IF(ITP.GT.ITMP) GO TO 2480
      DO 2470 L=ITP,ITMP
      DO 2460 LA=1,ITEMP
 2460 R(L,LA)=R(L+1,LA)
 2470 X(L)=X(L+1)
 2480 DO 2500 L=1,ITMP
      DO 2490 LA=ITP,NINDP
 2490 R(L,LA)=R(L,LA+1)
 2500 CONTINUE
      NINDP=ITMP
      GO TO 2420
C               ADD RANDOM COMPONENT TO PRESERVE VARIANCE
 2510 TEMP=0.
      DO 2520 L=1,6
      TEMP=TEMP+RNGEN(IXX)
 2520 TEMP=TEMP-RNGEN(IXX)
C               COMPUTE FLOW
      AL=(1.-DTRMC)**.5
      TEMP=TEMP*AL
      DO 2530 L=1,NINDP
 2530 TEMP=TEMP+B(L)*X(L)
      Q(M,K)=TEMP
      CD(M,K)=E
      TP=Q(M,K)
C               ADD NEW VALUE TO SUMS OF SQUARES AND CROSS PRODUCTS
      DO 2560 L=1,NSTAX
      IF(L.EQ.K) GO TO 2560
C               SUBSCRIPTS EXCEEDING NSTA RELATE TO PRECEDING MONTH
      LX=L-NSTA
      IF(LX.LT.1) THP=Q(M,L)
      IF(LX.GT.0) THP=Q(M-1,LX)
      IF (THP.EQ.T) GO TO 2560
C               COUNT AND USE ONLY RECORDED PAIRS
      NCAB(I,K,L)=NCAB(I,K,L)+1
      SUMA(I,K,L)=SUMA(I,K,L)+TP
      SUMB(I,K,L)=SUMB(I,K,L)+THP
      SQA (I,K,L)=SQA (I,K,L)+TP*TP
      SQB (I,K,L)=SQB (I,K,L)+THP*THP
      XPAB(I,K,L)=XPAB(I,K,L)+TP*THP
      IF(L.GT.NSTA) GO TO 2540
```

```
      NCAB(I,L,K)=NCAB(I,K,L)
      SUMA(I,L,K)=SUMB(I,K,L)
      SUMB(I,L,K)=SUMA(I,K,L)
      SQA (I,L,K)=SQB (I,K,L)
      SQB (I,L,K)=SQA (I,K,L)
      XPAB(I,L,K)=XPAB(I,K,L)
C              RECOMPUTE CORRELATION COEFFICIENTS TO INCLUDE NEW DATA
 2540 IF(NCAB(I,K,L).LE.2) GO TO 2560
      TEMP=NCAB(I,K,L)
      TMP=(SQA(I,K,L)-SUMA(I,K,L)*SUMA(I,K,L)/TEMP)*(SQB(I,K,L)-SUMB
     1(I,K,L)*SUMB(I,K,L)/TEMP)
C              ELIMINATE PAIRS WITH ZERO VARIANCE PRODUCT
      IF(TMP.LE.0.) GO TO 2560
      TMPB=1.
      TMPA=XPAB(I,K,L)-SUMA(I,K,L)*SUMB(I,K,L)/TEMP
C              RETAIN ALGEBRAIC SIGN
      IF(TMPA.LT.0.)TMPB=-TMPB
      TMPA=TMPA*TMPA/TMP
      RA(I,K,L)=TMPB*TMPA**.5
      ITP=I
      LA=L
      IF(L.LE.NSTA) GO TO 2550
      ITP=I-1
      IF(ITP.LT.1) ITP=12
      LA=LX
 2550 IF(SD(I,K).LT..0001.OR.SD(ITP,LA).LT..0001) RA(I,K,L)=0.
      IF(L.GT.NSTA) GO TO 2560
      RA(I,L,K)=RA(I,K,L)
 2560 CONTINUE
      ITMP=NYRS*12+1
      IF(M.GE.ITMP) GO TO 2580
      TEMP=Q(M,K)
      DO 2570 L=1,NSTA
      TMP=Q(M+1,L)
      IF(TMP.EQ.T) GO TO 2570
      LX=K+NSTA
      ITP=I+1
      IF(ITP.GT.12) ITP=1
      NCAB(ITP,L,LX)=NCAB(ITP,L,LX)+1
      SUMA(ITP,L,LX)=SUMA(ITP,L,LX)+TMP
      SUMB(ITP,L,LX)=SUMB(ITP,L,LX)+TP
      SQA (ITP,L,LX)=SQA (ITP,L,LX)+TMP*TMP
      SQB (ITP,L,LX)=SQB (ITP,L,LX)+TP*TP
      XPAB(ITP,L,LX)=XPAB(ITP,L,LX)+TP*TMP
      IF(NCAB(ITP,L,LX).LE.2) GO TO 2570
      TEMP=NCAB(ITP,L,LX)
      TMP=(SQA(ITP,L,LX)-SUMA(ITP,L,LX)*SUMA(ITP,L,LX)/TEMP)*
     1(SQB(ITP,L,LX)-SUMB(ITP,L,LX)*SUMB(ITP,L,LX)/TEMP)
      IF(TMP.LE.0.) GO TO 2570
      TMPB=1.
      TMPA=XPAB(ITP,L,LX)-SUMA(ITP,L,LX)*SUMB(ITP,L,LX)/TEMP
      IF(TMPA.LT.0.) TMPB=-TMPB
      TMPA=TMPA*TMPA/TMP
      RA(ITP,L,LX)=TMPB*TMPA**.5
      IF(SD(I,K).LT..0001.OR.SD(ITP,L).LT..0001) RA(ITP,L,LX)=0.
 2570 CONTINUE
 2580 CONTINUE
 2590 CONTINUE
 2600 CONTINUE
 2610 IF(IANAL.LE.0) GO TO 3100
C* * * * * * * CONVERT STANDARD DEVIATES TO FLOWS    * * * * * * * * * * *
      IF(NPASS.LE.1) GO TO 2630
      ITMPP=NYRS*12+1
      DO 2620 ITMP=1,100
      IF(LOTAP.EQ.NOTAP) GO TO 2630
      READ(IOTAP)
 2620 LOTAP=LOTAP+1
 2630 WRITE(6,10)
      WRITE (6,2640)
 2640 FORMAT(33H RECORDED AND RECONSTITUTED FLOWS)
      IF(NPASS.GT.1) WRITE(6,2650) IPASS
 2650 FORMAT(5H PASS,I3)
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```
      ANYRS=NYRS
      DO 2810 K=1,NSTA
      IF(K.GT.NSTX) WRITE(6,2660) (MO(I),I=1,12)
 2660 FORMAT (/11H  STA  YEAR,12I8,6X,5HTOTAL)
      M=1
      DO 2760 J=1,NYRS
      ITP=0
      DO 2720 I=1,12
      M=M+1
      TEMP=Q(M,K)
      TMP=SKEW(I,K)
      IF(TMP.NE.0.) TEMP=((TMP*(TEMP-TMP/6.)/6.+1.)**3 -1.)*2./TMP
      IF(QR(M,K).NE.E) GO TO 2690
      IF(TEMP.GT.2..AND.SD(I,K).GT..3) TEMP=2.+(TEMP-2.)*.3/SD(I,K)
      IF(TMP.LT.-.0001.OR.TMP.GT..0001) TMP=(-2.)/TMP
      IF(SKEW(I,K)) 2670,2690,2680
 2670 IF(TEMP.GT.TMP) TEMP=TMP
      GO TO 2690
 2680 IF(TEMP.LT.TMP) TEMP=TMP
 2690 TMP=TEMP*SD(I,K)+AV(I,K)
      Q(M,K)=10.**TMP-QQ(I,K)
      IF(Q(M,K).LT.0..AND.QMIN(I,K).GE.0.) Q(M,K)=0.
      QM(I)=QR(M,K)
      ITMP=NSUM(K,IPASS)
      IF(ITMP.LE.0) GO TO 2710
      TEMP=0.
      DO 2700 L=1,ITMP
      LX=IST(K,L,IPASS)
 2700 TEMP=TEMP+Q(M,LX)
      IF(Q(M,K).GT.TEMP) GO TO 2710
      QM(I)=ADJ
      IF(QR(M,K).NE.E) GO TO 2710
      QM(I)=ADJ1
      Q(M,K)=TEMP
 2710 IQ(I)=Q(M,K)+.5
 2720 ITP=ITP+IQ(I)
      IYR=IYRA+J
      IF(K.LE.NSTX) GO TO 2760
      IF(IPCHQ.LE.0)GO TO 2740
      WRITE(7,2730) ISTA(K),IYR,(IQ(I),I=1,12)
 2730 FORMAT(2I4,12I6)
 2740 WRITE(6,2750)ISTA(K),IYR,(IQ(I),QM(I),I=1,12) ,ITP
 2750 FORMAT(1X,I4,I6,I8,A1,11(I7,A1),I10)
 2760 CONTINUE
      IF(NPASS.LE.1) GO TO 2765
      WRITE(IQTAP)ISTA(K),(Q(M,K),M=1,ITMPP)
      NQTAP=NQTAP+1
 2765 IF(IRCON.LE.0) GO TO 2810
CN * * * * *RECOMPUTE MEAN AND STANDARD DEVIATION * * * * * * * * * * * *
      DO 2770 I=1,12
      AV(I,K)=0.
      SKEW(I,K)=0.
 2770 SD(I,K)=0.
      M=1
      DO 2790 J=1,NYRS
      DO 2780 I=1,12
      M=M+1
      TEMP=ALOG(Q(M,K)+QQ(I,K))*.4342945
      AV(I,K)=AV(I,K)+TEMP
      SKEW(I,K)=SKEW(I,K)+TEMP**3
 2780 SD(I,K)=SD(I,K)+TEMP*TEMP
 2790 CONTINUE
      DO 2800 I=1,12
      TEMP=AV(I,K)
      TMP=SD(I,K)
      TMP=(SD(I,K)-TEMP*TEMP/ANYRS)/(ANYRS-1.)
      IF(TMP.LT.0.) TMP=0.
      AV(I,K)=TEMP/ANYRS
      SD(I,K)=TMP**.5
      TMP=SKEW(I,K)
      SKEW(I,K)=0.
      IF(SD(I,K).LE..0005) GO TO 2800
```

```
      SKEW(I,K)=(ANYRS**2*TMP-3.*ANYRS*TEMP*TMPA+2.*TEMP**3)
     1/(ANYRS*(ANYRS-1.)*(ANYRS-2.)* SD(I,K)**3)
 2800 CONTINUE
 2810 CONTINUE
      LOTAP=NOTAP
      ITRNS=1
      IF(IRCON.LE.0) GO TO 2930
      IF(NCSTY.GT.0) GO TO 1290
C                PRINT ADJUSTED FREQUENCY STATISTICS
 2820 WRITE(6,10)
      WRITE(6,2830)
 2830 FORMAT(/30H ADJUSTED FREQUENCY STATISTICS)
      WRITE (6,890) (MO(I),I=1,12)
      DO 2840 K=NSTXX,NSTA
      WRITE (6,1010) ISTA(K),(AV(I,K),I=1,12)
      WRITE (6,1020) (SD(I,K),I=1,12)
      WRITE (6,1030) (SKEW(I,K),I=1,12)
      WRITE (6,1040) (DO(I,K),I=1,12)
 2840 CONTINUE
C                PRINT CONSISTENT CORRELATION MATRIX
      ITRNS=1
      GO TO 2170
 2850 IF (IPCHS.LE.0) GO TO 2870
C                PUNCH FREQUENCY STATISTICS
      DO 2860 K=NSTXX,NSTA
      WRITE(7,80)ISTA(K),(AV(I,K),I=1,12)
      WRITE(7,80)ISTA(K),(SD(I,K),I=1,12)
      WRITE(7,80)ISTA(K),(SKEW(I,K),I=1,12)
      WRITE(7,90)ISTA(K),(DO(I,K),I=1,12)
 2860 CONTINUE
C                COMPUTE COMBINATION FLOWS
C
 2870 IF(NCOMB.LE.0) GO TO 2910
      ITMP=12*NYRS+1
      DO 2900 M=2,ITMP
      DO 2890 KX=1,NCOMB
      K=KX+NSTA
      ITP=NSTAC(KX,IPASS)
      Q(M,K)=0.
      DO 2880 L=1,ITP
      ITEMP=KSTAC(KX,L,IPASS)
 2880 Q(M,K)=Q(M,K)+Q(M,ITEMP)*CSTAC(KX,L,IPASS)
 2890 CONTINUE
 2900 CONTINUE
C
C* * * * * * * MAX AND MIN RECONSTITUTED FLOWS * * * * * * * * * * * * * *
 2910 N=0
      ITRNS=1
      IF(MXRCS.LE.0) GO TO 2930
      ITMP=NYRS
 2920 IF(ITMP.LE.0) GO TO 2930
      N=N+1
      NJ=MXRCS
      ITMP=ITMP-MXRCS
      IF(ITMP.GE.0) GO TO 3730
      ITMP=MXRCS+ITMP
      NJ=ITMP
      ITMP=0
      GO TO 3730
 2930 IF(IGNRL.NE.2)GO TO 3020
C  * * * * * * COMPUTE GENERALIZED STATISTICS* * * * * * * * * * * * * * *
      WRITE(6,130)
      DO 3000 K=1,NSTA
C                AVERAGE CORRELATION COEFFICIENT
      DO 2950 L=1,K
      LX=L+NSTA
      RAV(K,L)=0.
      DO 2940 I=1,12
      TMP=RA(I,K,L)
      IF(L.GE.K)TMP=RA(I,K,LX)
 2940 RAV(K,L)=RAV(K,L)+TMP
      RAV(K,L)=RAV(K,L)/12.
```

```
      WRITE(6,70)ISTA(K),ISTA(L),RAV(K,L)
 2950 CONTINUE
C                AVERAGE LOGS FOR WET AND DRY SEASONS
      AVMX(K)=AV(11,K)+AV(12,K)+AV(1,K)
      IMX(K)=1
      AVMN(K)=AVMX(K)
      IMN(K)=1
      TMP=AV(12,K)+AV(1,K)+AV(2,K)
      IF(AVMX(K).GE.TMP)GO TO 2960
      AVMX(K)=TMP
      IMX(K)=2
      GO TO 2970
 2960 AVMN(K)=TMP
      IMN(K)=2
C                AND AVERAGE STANDARD DEVIATION
 2970 SDAV(K)=SD(1,K)+SD(2,K)
      DO 2990 I=3,12
      SDAV(K)=SDAV(K)+SD(I,K)
      TMP=AV(I-2,K)+AV(I-1,K)+AV(I,K)
      IF(AVMX(K).GE.TMP)GO TO 2980
      AVMX(K)=TMP
      IMX(K)=I
 2980 IF(AVMN(K).LE.TMP)GO TO 2990
      AVMN(K)=TMP
      IMN(K)=I
 2990 CONTINUE
      AVMX(K)=AVMX(K)/3.
      AVMN(K)=AVMN(K)/3.
      SDAV(K)=SDAV(K)/12.
 3000 CONTINUE
      WRITE(6,140)
      DO 3010 K=1,NSTA
      ITP=IMX(K)
      ITMP=IMN(K)
 3010 WRITE(6,120)ISTA(K),AVMX(K),AVMN(K),SDAV(K),MO(ITP),MO(ITMP)
C  * * * * * * APPLY GENERALIZED STATISTICS* * * * * * * * * * * * * * *
 3020 IF(IGNRL.LE.0)GO TO 3100
      DO 3080 K=1,NSTA
      KX=K+NSTA
C                INTERMEDIATE MONTHS
      NMXMN=IMN(K)-IMX(K)-3
      IF(NMXMN.LT.0)NMXMN=NMXMN+12
      NMNMX=6-NMXMN
      DO 3040 I=1,12
C                STANDARD DEVIATION UNIFORM, SKEW ZERO
      SKEW(I,K)=0.
      DS(I,K)=0.
      SD(I,K)=SDAV(K)
      DO 3030 L=1,NSTA
C                ZERO CORRELATION WITH OTHER STATIONS AND PRECEDING MONTH
      LX=L+NSTA
      RA(I,K,LX)=0.
      IF(L.GE.K)GO TO 3030
C                UNIFORM SERIAL CORREL INTERMEDIATE MONTHS AND INTER-STA
      RA(I,K,L)=RAV(K,L)
      RA(I,L,K)=RA(I,K,L)
 3030 CONTINUE
      RA(I,K,KX)=RAV(K,K)
      RA(I,K,K)=1.
 3040 CONTINUE
C                MEAN AND SERIAL CORREL, WET AND DRY SEASONS
      TMP=RAV(K,K)+.15
      TEMP=TMP-.3
      IF(TMP.GT..98)TMP=.98
      IF(TEMP.LT.0)TEMP=0.
      ITP=IMX(K)
      AV(ITP,K)=AVMX(K)-.1
      RA(ITP,K,KX)=TEMP
      ITP=IMX(K)-1
      IF(ITP.LT.1)ITP=12
      AV(ITP,K)=AVMX(K)+.2
      RA(ITP,K,KX)=TEMP
```

```
      ITP=IMX(K)-2
      IF(ITP.LT.1)ITP=ITP+12
      AV(ITP,K)=AVMX(K)-.1
      RA(ITP,K,KX)=TEMP
      ITP=IMN(K)
      AV(ITP,K)=AVMN(K)
      RA(ITP,K,KX)=TMP
      ITP=IMN(K)-1
      IF(ITP.LT.1)ITP=12
      AV(ITP,K)=AVMN(K)
      RA(ITP,K,KX)=TMP
      ITP=IMN(K)-2
      IF(ITP.LT.1)ITP=ITP+12
      AV(ITP,K)=AVMN(K)
      RA(ITP,K,KX)=TMP
C              MEANS FOR MONTHS FOLLOWING WET SEASON
      IF(NMXMN.LT.1)GO TO 3060
      ITP=IMX(K)
      TEMP=NMXMN+1
      TEMP=(AVMX(K)-.1-AVMN(K))/TEMP
      DO 3050 IX=1,NMXMN
      TMP=IX
      I=IMX(K)+IX
      IF(I.GT.12)I=I-12
 3050 AV(I,K)=AV(ITP,K)-TEMP*TMP
C              MEANS FOR MONTHS FOLLOWING DRY SEASON
 3060 IF(NMNMX.LT.1)GO TO 3090
      ITP=IMN(K)
      TEMP=NMNMX+1
      TEMP=(AVMX(K)-.1-AVMN(K))/TEMP
      DO 3070 IX=1,NMNMX
      TMP=IX
      I=IMN(K)+IX
      IF(I.GT.12)I=I-12
 3070 AV(I,K)=AV(ITP,K)+TEMP*TMP
 3080 CONTINUE
 3090 IGNRL=0
      IRCON=0
      GO TO 1730
 3100 IF(NYGG.LE.0.AND.NPROJ.LE.0.AND.NPASS.LE.1) GO TO 150      *
CP * * * * * * FLOW GENERATION EQUATIONS * * * * * * * * * * * * * * * * *
      NINDP=NSTA
      NVAR=NSTA+1
      DO 3200 I=1,12
      IP=I-1
      IF (IP.LT.1) IP=12
      DO 3190 K=1,NSTA
      DO 3140 L=1,NSTA
C              CORRELATIONS IN CURRENT MONTH
      IF (L.GE.K) GO TO 3120
      R(L,NVAR) = DBLE(RA(I,K,L))
      DO 3110 LA=L,NSTA
      LX=LA+NSTA
      IF (LA.LT.K) R(L,LA) = DBLE(RA(I,L,LA))
      IF (LA.GE.K) R(L,LA) = DBLE(RA(I,L,LX))
 3110 R(LA,L)=R(L,LA)
      GO TO 3140
C              CORRELATIONS WITH PRECEDING MONTH
 3120 LX=L+NSTA
      R(L,NVAR) = DBLE(RA(I,K,LX))
      DO 3130 LA=L,NSTA
      R(L,LA) = DBLE(RA(IP,L,LA))
 3130 R(LA,L)=R(L,LA)
 3140 CONTINUE
C     ==========
      CALL CROUT(R)
C     ==========
      DO 3150 L=1,NSTA
 3150 BETA(I,K,L)=B(L)
      IF(DTRMC.LE.1.) GO TO 3170
       WRITE(6,3160)I,K,DTRMC
 3160 FORMAT (34H INCONSISTENT CORREL MATRIX FOR I=,I3,4H  K=,I2,
```

```
     1 1H  DTRMS=,F6.3)
       ITRNS=2
       GO TO 1730
 3170 IF(DTRHC.GE.0.) GO TO 3180
       WRITE(6,70)I,K,DTRHC
       DTRHC=0.
 3180 ALCFT(I,K)=(1.-DTRHC)**.5
 3190 CONTINUE
 3200 CONTINUE
C  * * * * * * GENERATE FLOWS  * * * * * * * * * * * * * * * * * * * * * * *
       IF(NPASS.LE.1) GO TO 3240
 3210 IF(LSTAT.EQ.NSTAT) GO TO 3220
       READ (ISTAT)
       LSTAT=LSTAT+1
       GO TO 3210
 3220 WRITE(ISTAT)NSTXX,NSTA,(ISTA(K),K=1,NSTA)
       NSTAT=NSTAT+1
       LSTAT=NSTAT
       DO 3230 K=1,NSTA
       WRITE(ISTAT) ISTA(K),(AV(I,K),SD(I,K),SKEW(I,K),DG(I,K),
     1        (BETA(I,K,L),L=1,NSTA),ALCFT(I,K),I=1,12)
 3230 NSTAT=NSTAT+1
       LSTAT=NSTAT
       IF(IPASS.LT.NPASS) GO TO 200
 3240 JA=1
       IPASS=1
       N=0
       MA=0
       IF (NPROJ.LE.0) GO TO 3310
C0 * * * * * * PROJECTED FLOW SEQUENCES  * * * * * * * * * * * * * * * * *
 3250 JA=IYRPJ-IYRA
       NJ=LYRPJ-IYRA
       ITMP=0
       ITP=MTHPJ-IMNTH-1
       IF(ITP.NE.0) GO TO 3260
       ITMP=12
 3260 IF (ITP.LT.1) ITP=ITP+12
       MA=(JA-1)*12+ITP+1-ITMP
       DO 3290 K=1,NSTA
       IF (SD(ITP,K).EQ.0..OR.MA.EQ.1) GO TO 3280
       TEMP=ALOG(Q(MA,K)+DG(ITP,K))*.4342945
       QPREV(K)=(TEMP-AV(ITP,K))/SD(ITP,K)
       IF (SKEW(ITP,K).EQ.0.) GO TO 3290
       TEMP=.5*SKEW(ITP,K)*QPREV(K)+1.
       TMP=1.
       IF (TEMP.GE.0.) GO TO 3270
       TEMP=(-TEMP)
       TMP=(-TMP)
 3270 QPREV(K)=6.*(TMP*TEMP**(1./3.)-1.)/SKEW(ITP,K)+SKEW(ITP,K)/6.
       GO TO 3290
 3280 QPREV(K)=0.
 3290 CONTINUE
       JX=IYRPJ-1
C               N = SEQUENCE NO., M = MONTH NO., JX = YEAR NO.
 3300 N=N+1
       GO TO 3330
C               START WITH ZERO DEVIATION AT ALL STATIONS
 3310 DO 3320 K=1,KSTA
 3320 QPREV(K)=0.
C               GENERATE 2 YEARS FOR DISCARDING
       NJ=2
       JX=-2
 3330 IF(NPASS.LE.1) GO TO 3400
       IF(IPASS.GT.1) GO TO 3340
       REWIND ISTAT
       NOTAP=0
       ISTAP=0
 3340 REWIND IOTAP
       LOTAP=0
       READ(ISTAT)NSTXX,NSTA,(ISTA(K),K=1,NSTA)
       NSTX=NSTXX-1
       IF(NSTX.LE.0) GO TO 3380
```

```
      ITP=NJ*12+1
      DO 3370 K=1,NSTX
      IF(IPASS.LE.1) GO TO 3360
 3350 READ(IOTAP) ITEMP,(Q(M,K),M=2,ITP)
      LOTAP=LOTAP+1
      IF(ITEMP.NE.ISTA(K)) GO TO 3350
 3360 READ(ISTAT) IP,(AV(I,K),SD(I,K),SKEW(I,K),DQ(I,K),(BETA(I,K,L),L=1
     1,NSTA),ALCFT(I,K),I=1,12)
 3370 CONTINUE
 3380 DO 3390 K=NSTXX,NSTA
      ISTAP=ISTAP+1
      IF(N.GT.0) QPREV(K)=QSTAP(ISTAP)
 3390 READ(ISTAT) IP,(AV(I,K),SD(I,K),SKEW(I,K),DQ(I,K),(BETA(I,K,L),L=1
     1,NSTA),ALCFT(I,K),I=1,12)
CR * * * * * * GENERATE CORRELATED STANDARD DEVIATE  * * * * * * * * * * *
 3400 IF(IPASS.EQ.1) JXTMP=JX
      NCOMB=MCOMB(IPASS)
      NTNDM=MTNDM(IPASS)
      DO 3420 K=1,NSTA
      DO 3410 I=1,12
      AVG(I,K)=0.
      SDV(I,K)=0.
 3410 CONTINUE
 3420 CONTINUE
      IF(N.LE.0) GO TO 3440
      WRITE(6,10)
      WRITE (6,3430) N
 3430 FORMAT (27H GENERATED FLOWS FOR PERIOD,I3)
      IF(NPASS.GT.1) WRITE(6,2650) IPASS
 3440 DO 3510 J=JA,NJ
      M=12*(J-1)+1
      DO 3500 I=1,12
      M=M+1
      IF(NSTX.LE.0) GO TO 3460
      DO 3450 K=1,NSTX
 3450 QPREV(K)=Q(M,K)
 3460 IF (M.LE.MA) GO TO 3500
      DO 3490 K=NSTXX,NSTA
C               RANDOM COMPONENT
      TEMP=0.
      DO 3470 L=1,6
      TEMP=TEMP+RNGEN(IXX)
 3470 TEMP=TEMP-RNGEN(IXX)
      TEMP=TEMP*ALCFT(I,K)
      DO 3480 L=1,NSTA
 3480 TEMP=TEMP+BETA(I,K,L)*QPREV(L)
      AVG(I,K)=AVG(I,K)+TEMP
      SDV(I,K)=SDV(I,K)+TEMP*TEMP
      Q(M,K)=TEMP
      QPREV(K)=TEMP
 3490 CONTINUE
 3500 CONTINUE
 3510 CONTINUE
      IF(NPASS.LE.1) GO TO 3550
 3520 IF(LOTAP.EQ.NOTAP) GO TO 3530
      READ (IOTAP)
      LOTAP=LOTAP+1
      GO TO 3520
 3530 ITP=NJ*12+1
      ISTAP=ISTAP-NSTA+NSTX
      DO 3540 K=NSTXX,NSTA
      WRITE(IOTAP)ISTA(K),(Q(M,K),M=2,ITP)
      NOTAP=NOTAP+1
      ISTAP=ISTAP+1
      IF (ISTAP.GT.KSTAP) GO TO 160
 3540 QSTAP(ISTAP)=Q(ITP,K)
 3550 ANLOG=NJ-JA+1
      DO 3670 K=NSTXX,NSTA
      IF(NJ+JXTMP.GT.0) WRITE(6,2660) (NO(I),I=1,12)
      DO 3560 I=1,12
      AVG(I,K)=AVG(I,K)/ANLOG
      SDV(I,K)=((SDV(I,K)-AVG(I,K)**2*ANLOG)/ANLOG)**.5
```

```
 3560 CONTINUE
      JX=JXTMP
      DO 3660 J=JA,NJ
      JX=JX+1
      M=12*J-11
      IF (JX.LE.0) GO TO 3660
      ITP=0
      DO 3650 I=1,12
      M=M+1
      IF (M.LE.MA) GO TO 3640
C              TRANSFORM TO LOG PEARSON TYPE III VARIATE (FLOW)
      TMP=SKEW(I,K)
      IF(ANLOG.GT.19..AND.SDV(I,K).GT.0.)
     $    Q(M,K)=(Q(M,K)-AVG(I,K))/SDV(I,K)
      IF (TMP.EQ.0.) GO TO 3600
C                                                           WITHDREW *
      TMP=((TMP*(Q(M,K)-TMP/6.)/6.+1.)**3 -1.)*2./TMP
      TEMP=(-2.)/SKEW(I,K)
      IF(SKEW(I,K)) 3580,3600,3590
 3580 IF(TMP.GT.TEMP)TMP=TEMP
      GO TO 3610
 3590 IF(TMP.LT.TEMP) TMP=TEMP
      GO TO 3610
 3600 TMP=Q(M,K)
 3610 IF(TMP.GT.2..AND.SD(I,K).GT..3) TMP=2.+(TMP-2.)*.3/SD(I,K)
      TMP=TMP*SD(I,K)+AV(I,K)
      Q(M,K)=10.**TMP-DQ(I,K)
      ITMP=NSUM(K,IPASS)
      IF(ITMP.LE.0) GO TO 3630
      TEMP=0.
      DO 3620 L=1,ITMP
      LX=IST(K,L,IPASS)
 3620 TEMP=TEMP+Q(M,LX)
      IF(Q(M,K).LT.TEMP) Q(M,K)=TEMP
 3630 IF(Q(M,K).LT.0..AND.QMIN(I,K).GE.0.) Q(M,K)=0.
 3640 IQ(I)=Q(M,K)+.5
      ITP=ITP+IQ(I)
 3650 CONTINUE
C                                                           WITHDREW *
      IQ(13)=ITP
      WRITE (6,100) ISTA(K),JX,(IQ(I),I=1,13)
      IF(IPCHQ.LE.0)GO TO 3660
      WRITE(7,2730) ISTA(K), JX,(IQ(I),I=1,12)
 3660 CONTINUE
 3670 CONTINUE
      IF(NCOMB.LE.0) GO TO 3720
      DO 3710 J=JA,NJ
      M=12*J-11
      DO 3700 I=1,12
      M=M+1
C              COMPUTE COMBINATION FLOWS
      DO 3690 KX=1,NCOMB
      K=KX+NSTA
      ITP=NSTAC(KX,IPASS)
      Q(M,K)=0.
      DO 3680 L=1,ITP
      ITEMP=KSTAC(KX,L,IPASS)
 3680 Q(M,K)=Q(M,K)+Q(M,ITEMP)*CSTAC(KX,L,IPASS)
 3690 CONTINUE
 3700 CONTINUE
 3710 CONTINUE
 3720 IF(N.LT.NPROJ) GO TO 3250
      IF(NYMXG.LE.0)GO TO 3860
C$ * * * * * * MAX AND MIN GENERATED FLOWS * * * * * * * * * * * * * * * *
      IF(JX.LE.0)GO TO 3870
C              SKIP MAXMIN IF REMAINING YEARS INSUFFICIENT
      IF(JX.GT.0.AND.NJ.LT.NYMXG)GO TO 150
      ITRNS=0
 3730 ITP=NSTA+NCOMB
      DO 3800 K=NSTYX,ITP
C              MAX CALENDAR MO 1-12, MAX MO 13, 6-MO 14, 54-MO 15
      DO 3740 I=1,15
```

```
 3740 SMO(I,K)=-T
C           MIN CALENDAR MO 16-27, MIN MO 28, 6-MO 29, 54-MO 30
      DO 3750 I=16,30
 3750 SMO(I,K)=T
C           TMP = 6-MO, TEMP = 54-MO VOLUME, TMPA = 1-MO
      TEMP=0.
      TMP=0.
      AVGQ(K)=0.
      NO=0
      M=1
      IF(ITRNS.GT.0) M=(N-1)*MXRCS*12+1
      DO 3790 J=1,NJ
      DO 3780 I=1,12
      IX=I+15
      M=M+1
      TMPA=Q(M,K)
      AVGQ(K)=AVGQ(K)+TMPA
      NO=NO+1
      IF(TMPA.GT.SMO(I,K))SMO(I,K)=TMPA
      IF(TMPA.LT.SMO(IX,K))SMO(IX,K)=TMPA
      IF(TMPA.GT.SMO(13,K))SMO(13,K)=TMPA
      IF(TMPA.LT.SMO(28,K))SMO(28,K)=TMPA
      TMP=TMP+TMPA
      TEMP=TEMP+TMPA
      IF(M.LT.8)GO TO 3760
      TMP=TMP-Q(M-6,K)
      IF(TMP.GT.SMO(14,K))SMO(14,K)=TMP
      IF(TMP.LT.SMO(29,K))SMO(29,K)=TMP
      IF(M.LT.56)GO TO 3770
      TEMP=TEMP-Q(M-54,K)
      IF(TEMP.GT.SMO(15,K))SMO(15,K)=TEMP
      IF(TEMP.LT.SMO(30,K))SMO(30,K)=TEMP
      GO TO 3780
 3760 SMO(14,K)=TMP
 3770 SMO(15,K)=TEMP
 3780 CONTINUE
 3790 CONTINUE
C           AVERAGE MONTHLY FLOW
      TEMP=NO
      AVGQ(K)=AVGQ(K)/TEMP
 3800 CONTINUE
      WRITE (6,10)
      IF(ITRNS.GT.0)WRITE(6,3810)N,NJ
 3810 FORMAT (/27H MAXIMUM VOLUMES FOR PERIOD,I3,3H OF,I4,
     142H YEARS OF RECORDED AND RECONSTITUTED FLOWS)
      IF(ITRNS.LE.0)WRITE(6,3820)N,NJ
 3820 FORMAT (/27H MAXIMUM VOLUMES FOR PERIOD,I3,3H OF,I4,
     125H YEARS OF SYNTHETIC FLOWS)
      WRITE(6,810)(MO(I),I=1,12)
      ITP=NSTA+NCOMM
      DO 3840 K=NSTXX,ITP
      ITEMP=AVGQ(K)+.5
      DO 3830 I=1,15
 3830 IQ(I)=SMO(I,K)+.5
      WRITE(6,840)ISTA(K),(IQ(I),I=1,15),ITEMP
 3840 CONTINUE
      WRITE(6,850)
      WRITE(6,810)(MO(I),I=1,12)
      DO 3860 K=NSTXX,ITP
      DO 3850 I=1,15
 3850 IQ(I)=SMO(I+15,K)+.5
      WRITE(6,840)ISTA(K),(IQ(I),I=1,15)
 3860 CONTINUE
C           TRANSFER BACK TO RECONSTITUTED FLOWS
      IF(ITRNS.GT.0)GO TO 2920
 3870 NJ = NYMXG
      GO TO 3990
 3880 NJ = KYR
 3890 IF(NPASS.LE.1) GO TO 3900
      IPASS=IPASS+1
      IF(N.EQ.0.AND.IPASS.LE.NPASS) GO TO 3310
      IF(IPASS.LE.NPASS) GO TO 3340
```

```
      IPASS=1
C                 GO TO NEW JOB
 3900 IF(NYRG.LE.0) GO TO 150
      IF(NJ.GT.NYRG)NJ=NYRG
      NYRG=NYRG-NJ
      GO TO 3300
      END
      SUBROUTINE CROUT(RX)
      DIMENSION B(10),R(10,11),RX(10,11)
      DOUBLE PRECISION R,B,RX
      COMMON DTRMC,NINDP,B
      NVAR=NINDP+1
      DO 20 J=1,NINDP
      B(J)=0.
      DO 10 K=1,NVAR
   10 R(J,K)=RX(J,K)
   20 CONTINUE
      IF(NINDP.GT.1)GO TO 30
      B(1)=R(1,2)/R(1,1)
      DTRMC=B(1)*B(1)
      RETURN
C  * * * * * * DERIVED MATRIX  * * * * * * * * * * * * * * * * * * * * * * *
   30 DO 40 K=2,NVAR
   40 R(1,K)=R(1,K)/R(1,1)
      DO 80 K=2,NINDP
      ITP=K-1
      DO 60 J=K,NINDP
      DO 50 I=1,ITP
      L=K-I
   50 R(J,K)=R(J,K)-R(J,L)*R(L,K)
      IF(J.EQ.K) GO TO 60
      R(K,J)=R(J,K)/R(K,K)
   60 CONTINUE
      DO 70 I=1,ITP
      L=K-I
   70 R(K,NVAR)=R(K,NVAR)-R(L,NVAR)*R(K,L)
      TEMP=DABS(R(K,K))
      IF(TEMP.GT..000001) GO TO 80
      DTRMC=1.5
      RETURN
   80 R(K,NVAR)=R(K,NVAR)/R(K,K)
C  * * * * * * BACK SOLUTION * * * * * * * * * * * * * * * * * * * * * * * *
      B(NINDP)=R(NINDP,NVAR)
      DO 100 I=2,NINDP
      J=NVAR-I
      IX=I-1
      B(J)=R(J,NVAR)
      DO 90 L=1,IX
      K=J+L
   90 B(J)=B(J)-B(K)*R(J,K)
  100 CONTINUE
      DTRMC=0.
      DO 110 J=1,NINDP
  110 DTRMC=DTRMC+B(J)*RX(J,NVAR)
      RETURN
      END
      FUNCTION RNGEN(IX)
C     RANDOM NUMBER SUBROUTINE FOR A BINARY MACHINE
C     GENERATES UNIFORM RANDOM NUMBERS IN THE INTERVAL 0 TO 1
C     GENERAL USAGE IS AS FOLLOWS
C     X=RNGEN(IX)
C     IX SHOULD BE INITIALIZED TO ZERO IN THE PROGRAM
C     IARG CAN BE ANY LARGE, ODD INTEGER
C     CONSTANTS MUST BE COMPUTED BY FOLLOWING EQUATIONS
C     * * * *  ICON1=(2**((B+1)/2))+3   * * * *
C     * * * *  ICON2=(2**B)-1           * * * *
C     * * * *  FCON3=1./(2.**B)         * * * *
C     WHERE B= NUMBER OF BITS IN THE INTEGER WORD
C
      DATA IARG/759821/
      IF(IARG.EQ.IX) GO TO 10
      IX=IARG
```

```
      IY=IX
      ICON1=16777219
   10 IY=IY*ICON1
      ICON2=281474976710655
      IF(IY.LT.0) IY=IY+ICON2+1
      RNGEN=IY
      FCON3=.3552713678E-14
      RNGEN=RNGEN*FCON3
      RETURN
      END
```

EXHIBIT 7

INPUT DATA 723-X6-L2340

CARD	VARIABLE		COMMENTS
A			Three title cards, first must have A in column 1.
B			First specification card.
	1. IYRA	-	Earliest year of record at any station.
	2. IMNTH	-	Calendar month number of first month of water year.
	3. IANAL	-	Indicator, positive value calls for statistical analysis routines.
	4. MXRCS	-	Number of years in each period of recorded and reconstituted flows for which maximum and minimum values are to be obtained, dimensioned for 100.
	5. NYRG	-	Total number of years of hypothetical flows to be generated.
	6. NYMXG	-	Number of years in each period of generated flows which maximum and minimum values are to be obtained, dimensioned for 100.
	7. NPASS	-	Number of consecutive passes, each pass consisting of a new group of stations which can be correlated with specified stations in previous passes, dimensioned for 5.
	8. IPCHQ	-	Indicator, positive value calls for writing recorded and reconstituted flows and generated flows on Tape 7.
	9. IPCHS	-	Indicator, positive value calls for writing statistics on Tape 7.
	10. NSTA	-	Number of stations at which flows are to be generated, not required if flow data are supplied. NSTA + NCOMB (C-1) dimensioned for 10.
C			Second specification card.
	1. NCOMB	-	Number of combinations of stations, the totals of which are used to obtain maximum and minimum flows, dimensioned for 2. If positive, provide D and E cards.
	2. NTNDM	-	Number of tandem situations, compares sum of monthly values of upstream stations with downstream station and adjusts if value is less than sum and that station's value has been estimated or generated, dimension for 10. If positive, provide F card.
	3. NCSTY		Number of consistency tests. Adjusts standard deviation of a dependent station in tandem with an independent station to prevent frequency curves from crossing, dimensioned for 10. If positive, provide G card.

CARD	VARIABLE		COMMENTS
C (Cont'd)			
	4. IGNRL	-	Indicator, + 1 calls for reading generalized statistics and using for generation, + 2 calls for computing generalized statistics from flow data and using for generation.
	5. NPROJ	-	Number of projections of future flows from present conditions, usually 0.
	6. IYRPJ	-	Year of start of each projection.
	7. MTHPJ	-	Calendar month of start of each projection.
	8. LYRPJ	-	Last year of each projection, number of recorded and reconstituted years plus number of projected years dimensioned for 100.
D			Identification of combination, NCOMB (C-1) sets of D and E cards.
	1. NSTAC	-	Number of stations in this combination, dimensioned for 10.
	2. ISTAC	-	Station number (NSTAC values).
E			Combining coefficients, NCOMB (C-1) sets of D and E cards.
	1. NSTAC	-	Same as D-1.
	2. CSTAC	-	Coefficient of flow used for adding, corresponds to respective items in D-2.
F			Identification of tandem situation, NTNDM (C-2) cards.
	1. ISTN	-	Station number of downstream station.
	2. NSMX	-	Number of upstream stations, dimensioned for 10.
	3. ISTT	-	Station number of upstream station (NSMX values).
G			Identification of consistency test, NCSTY (C-3) cards.
	1. ISTX	-	Independent station number.
	2. ISTY	-	Dependent station number.
H			Flow data, cards in any order, omit if IANAL (B-3) is not positive, follow all flow data cards by 1 blank card (I card).
	1. Cols 2-4, Station number		
	2. Cols 5-8, Year number.		

CARD	VARIABLE	COMMENTS
H (Cont'd)		
	3.	Cols 9-14, 15-20, etc., Flow in desired units. Units should be selected so generated flows will not exceed 999,999. Use -1 for missing record. If record for entire year is missing, omit card for that year.
I		Card blank after Col 1 to indicate end of flow data, omit if IANAL (B-3) is not positive.
J		Identification of stations in previous passes to be used in current pass, supply only if NPASS (B-7) is greater than 1. The variables NCOMB, NTNDM, and NCSTY apply to the current pass only.
	1. NCOMB	- Number of combinations of stations, the totals of which are used to obtain maximum and minimum flows, dimensioned for 2. If positive, provide D and E cards.
	2. NTNDM	- Number of tandem situations, compares sum of monthly values of upstream stations with downstream station and adjusts if value is less than sum and that station's value has been estimated or generated, dimension for 10. If positive, provide F card.
	3. NCSTY	- Number of consistency tests. Adjusts standard deviation of a dependent station in tandem with an independent station to prevent frequency curves from crossing, dimensioned for 10. If positive, provide G card.
	4. NSTX	- Number of stations from previous passes which are to be used with the additional data in current pass as a means of maintaining consistent flows between groups of stations, number of stations from previous passes plus number of new stations dimensioned for 10.
	5. ISTA	- Station number of station in a previous pass which is to be used in current pass (NSTX values). Must be in same order as stations first appear.

Note: Flow data for current pass supplied as described for H card and follow data with a blank card (I card), supply NPASS-1 sets of J, H, and I cards (also D,E,F, and G, if necessary) when NPASS greater than 1.

CARD	VARIABLE	COMMENTS
K		Preceding-month correlation coefficients for first station, omit if IANAL (B-3) is positive (NSTA cards).
	1. ISTA(K)	- Cols 2-4, Number of first station.
	2. ISTA(L)	- Cols 5-8, Number of station from 1 to NSTA (B-10) on successive cards. If IGNRL (C-4) = 1, only first card is used.
	3. RA(I,K,LX)	- Cols 9-14, 15-20, etc., Correlation coefficients for successive months between flows at first station and preceding-month flows at stations from 1 to NSTA (B-10) on separate cards. If IGNRL (C-4) = 1, only generalized coefficient (in cols 9-14) is given.

CARD	VARIABLE		COMMENTS
L*			Current-month correlation coefficients, omit if IANAL (B-3) is positive, (NSTA-1) pairs of L and M cards.
	1. ISTA(K)	-	Cols 2-4, Number of station, progressing from K = 2 through NSTA (B-10) stations on different sets of L and M cards.
	2. ISTA(L)	-	Cols 5-8, Number of station, progressing on different cards through all stations from L = 1 to K-1.
	3. RA(I,K,L)	-	Cols 9-14, 15-20, etc., Correlation coefficient for each successive calendar month between flows at station K and concurrent flows at station L (12 items). If IGNRL (C-4) = 1, only generalized coefficient in cols 9-14 is given.
M*			Preceding-month correlation coefficients for remaining stations, omit if IANAL (B-3) is positive. Paired with L card.
	1. ISTA(K)	-	Cols 2-4, Same station number as on corresponding L card (L-1).
	2. ISTA(L)	-	Cols 5-8, Number of station, progressing in same order on different cards through all stations from L = 1 to NSTA (B-10). If IGNRL (C-4) = 1, only card with L = K is used.
	3. RA(I,K,LX)	-	Cols 9-14, 15-20, etc., Correlation coefficient for each successive calendar month between flows at station K and flows in preceding month at station L (12 items). If IGNRL (C-4) = 1, only generalized coefficient in Cols 9-14 is given.
N			Generalized frequency statistics, omit if IANAL (B-3) is positive or IGNRL (C-4) does not equal 1.
	1. ISTA(K)	-	Cols 2-8, Station number for NSTA (B-10) stations on successive cards in same order as supplied by L cards (L-1).
	2. AVMX(K)	-	Cols 9-14, Average mean logarithm for wet season (3 months).
	3. AVMN(K)	-	Cols 15-20, Average mean logarithm for dry season (3 months).
	4. SDAV(K)	-	Cols 21-26, Average standard deviation for the 12 months.

* Sets of L and M cards are required for each station from K = 2 to NSTA.

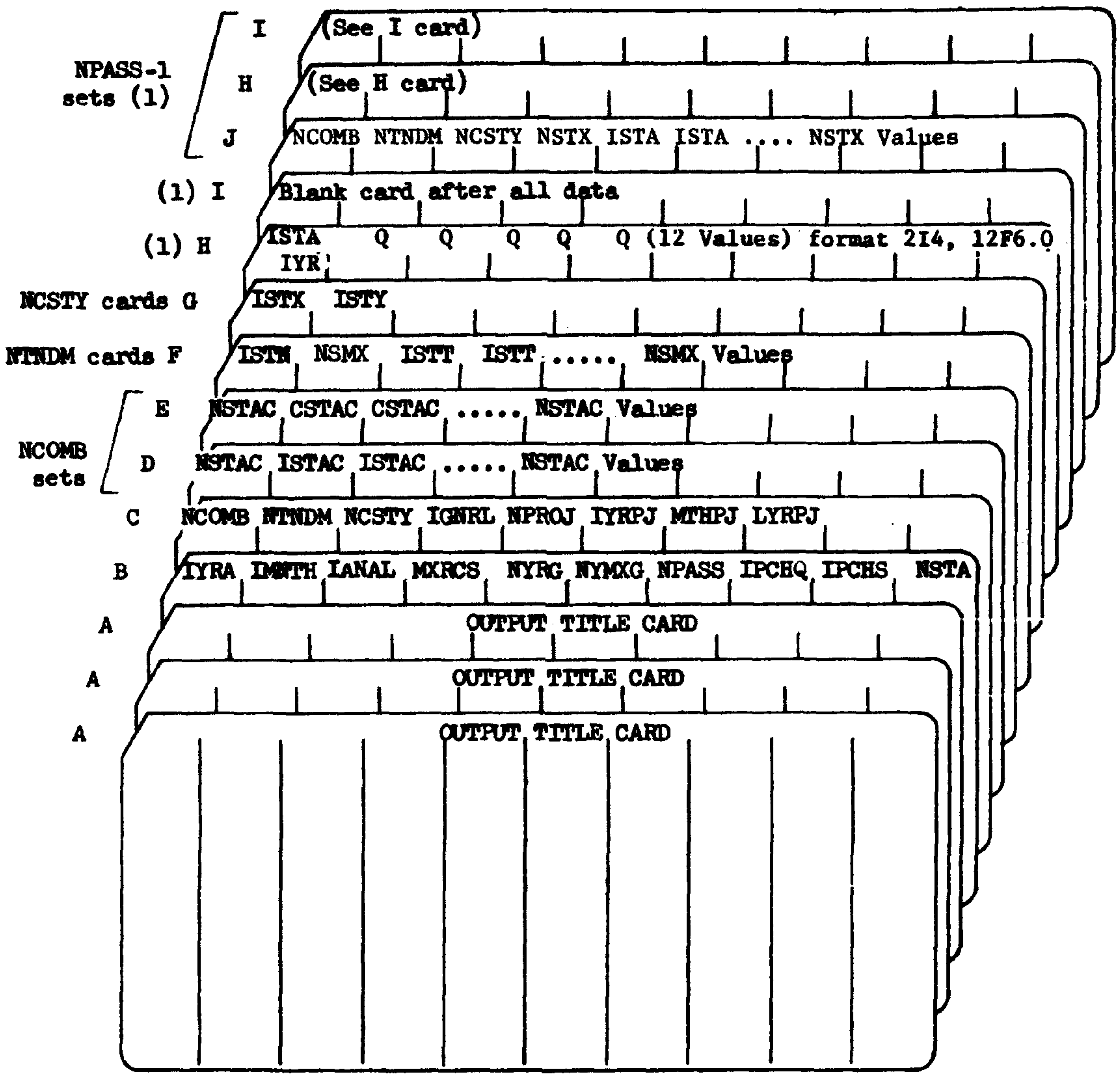
CARD	VARIABLE	COMMENTS
N (Cont'd)		
	5. MOMX(K)	- Calendar number of last month of wet season.
	6. MOMN(K)	- Calendar number of last month of dry season.
O		Mean logarithms, omit if IANAL (B-3) is positive or IGNRL (C-4) equals 1.
	1. ISTA(K)	- Same as (M-1).
	2. AV(I,K)	- Cols 9-14, 15-20, etc., Mean logarithms for successive calendar months.
P		Standard deviations, omit if IANAL (B-3) is positive or IGNRL (C-4) equals 1.
	1. ISTA(K)	- Same as (M-1).
	2. SD(I,K)	- Cols 9-14, 15-20, etc., Standard deviations for successive calendar months.
Q		Skew coefficients, omit if IANAL (B-3) is positive or IGNRL (C-4) equals 1.
	1. ISTA(K)	- Same as (M-1).
	2. SKEW(I,K)	- Cols 9-14, 15-20, etc., Skew coefficients for successive calendar months.
R		Flow increments, omit if IANAL (B-3) is positive or IGNRL (C-4) equals 1.
	1. ISTA(K)	- Same as (M-1).
	2. DQ(I,K)	- Cols 9-14, 15-20, etc., Flow increments for successive calendar months.

Five blank cards with A in Col 1 of first should follow last job.

Note: Cards K through R are not required if cards H and I are supplied. Cards K through R are as punched by computer when IPCHS is positive.

EXHIBIT 8

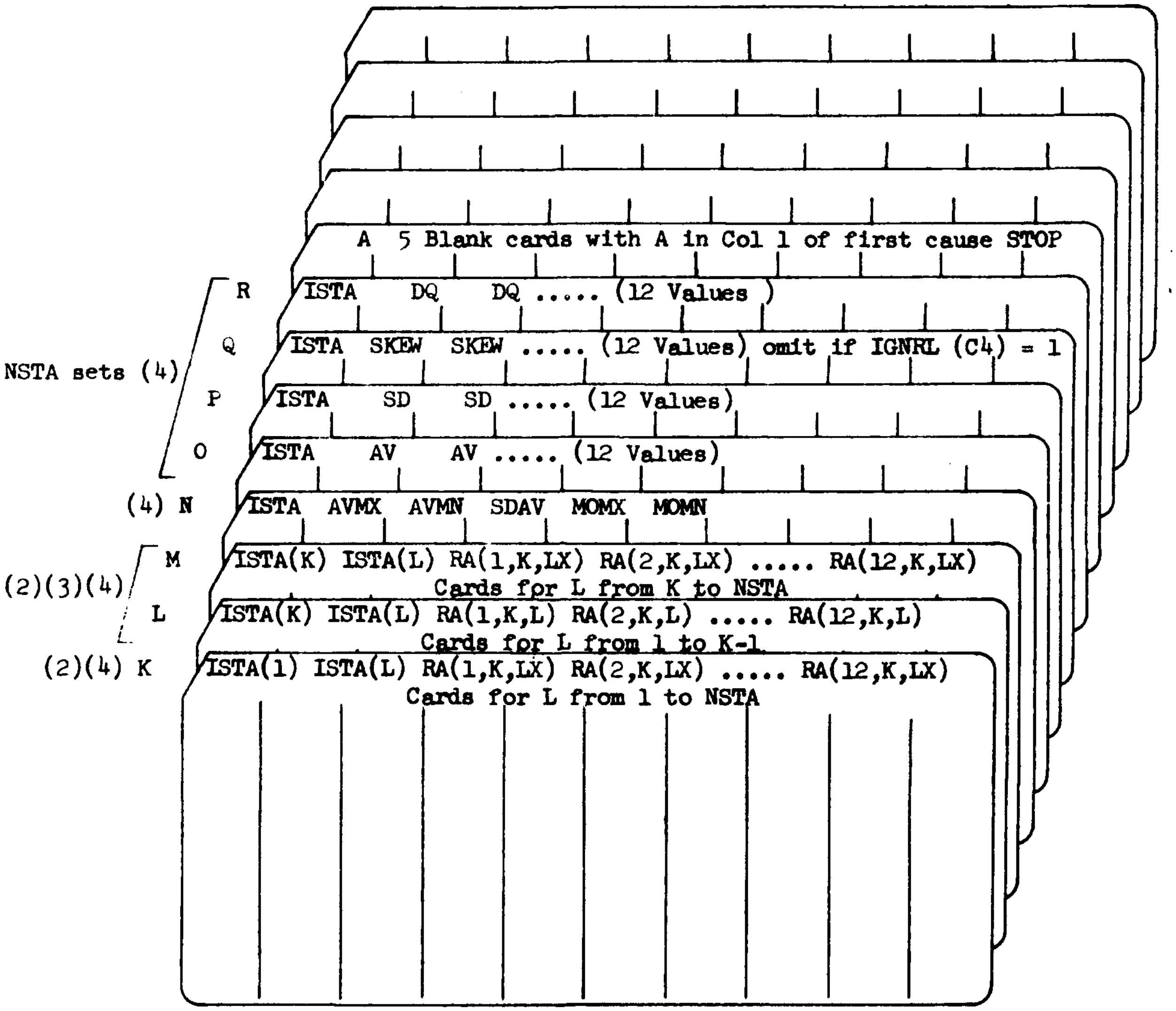
SUMMARY OF REQUIRED CARDS
723-X6-L2340



Notes:

(1) Supply only if IANAL (B3) is positive. Repeat H card for each station-year of data before supplying I card.

SUMMARY OF REQUIRED CARDS
Continued
723-X6-L2340



(2) L designates correlation with current month and LX with preceding month. If IGNRL(C4) = 1, only one (generalized) coefficient is given following station numbers on each card and only 1 K and M card is used for each K station, with L = K. Use same format as H card.
(3) Repeat set of L and M cards for each K station except first.
(4) Omit if IANAL (B3) is positive.